CDM Camp Dresser & McKee

Report

LYNN WATER & SEWER COMMISSION

Summer & Cottage Streets Combined Sewer Separation Project Inflow Investigation Report

January 1999

CDM Camp Dresser & McKee Inc.

consulting engineering construction operations

Ten Cambridge Center
Cambridge, Massachusetts 02142
Tel: 617 252-8000 Fax: 617 621-2565

February 10, 1999

Mr. Stephen Smith
Executive Director
Lynn Water and Sewer Commission
400 Parkland Avenue
Lynn, Massachusetts 01905

Subject: Lynn Water and Sewer Commission
Summer and Cottage Street Sewer Separation
Inflow Investigation Report

Dear Mr. Smith:

We are pleased to submit fifteen (15) copies of the *"Inflow Investigation Report"* dated January 1999. The report is submitted for your review and comment prior to finalizing the report and submittal to the Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (MDEP). The report has been prepared in accordance with Task I of our Agreement dated April 24, 1997. The report presents the results of the extensive inflow investigations conducted by Camp Dresser & McKee Inc. (CDM) in the Summer Street and Cottage Street Tributary Areas located in West Lynn. The findings provide the basis for implementation of the Disconnect Program voted by the Commission to eliminate inflow to the sewer collection system by December 31, 2004 as required by the Modified Consent Decree dated November 18, 1994.

Please feel free to contact me if you have any questions regarding the report.

Very truly yours,

CAMP DRESSER & McKEE INC.

Ronald M. Lepri

Ronald M. Lepri
Vice President

RML/dmd

Enclosures

cc: Mr. Daniel F. O'Neill, LWSC
Mr. William F. Callahan, CDM

Executive Summary

Under the Clean Water Act (CWA) of 1986, municipalities nationwide must reduce or eliminate combined sewer overflows (CSOs). To comply with CWA, the Lynn Water and Sewer Commission (LWSC) and the Environmental Protection Agency (EPA), entered into a Modified Consent Decree on November 2, 1987 (amended February 8, 1995).

In compliance with the Consent Decree, an inflow detection program was conducted in Lynn on the Cottage Street and Summer Street Tributary Area Sewer System. These areas contribute to CSOs to the Little River (CSO #003). The program successfully inspected 75 percent of the homes in the study area for private sources of inflow. Furthermore, the entire sewer pipeline within the area was smoke tested to identify public and private sources of inflow. A dyed water flooding and testing program was conducted to pinpoint ambiguous sources. The investigation identified some 103 public and 527 private confirmed or potential inflow sources.

Public inflow sources were addressed as detailed in the *"Summer and Cottage Streets Combined Sewer Separation Project Draft Preliminary Report"* (CDM, November 1997). Catch basins presently attached to the sewer system will be disconnected and attached to the new, separate drain system.

Camp Dresser & McKee Inc. (CDM) performed an analysis of the capacity of the Summer Street sewer, where CSO #003 is located, to determine the extent of the need to disconnect private inflow sources. Proposed system improvements to remove public inflow in the tributary area will significantly reduce stormwater flow to CSO #003. The analysis further indicates that overflows will continue to occur after the sewer separation project unless private inflow sources are disconnected or the downstream interceptor system is expanded.

CDM recommended LWSC implement a voluntary removal program to disconnect sump pumps and downspouts in the tributary area. Sump pumps in the Summer Street tributary area should be given priority, as they are a significant, direct contributor to overflows at CSO #003.

On February 9, 1998, the Commission voted to implement the recommended program, providing full reimbursement for work performed, with the stipulation that costs over $500 require two or three estimates.

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Summer Street and Cottage Street Tributary Areas Inflow Investigation Report

Introduction

Under the Clean Water Act (CWA) of 1986, municipalities nationwide must reduce or eliminate combined sewer overflows (CSOs). A CSO event occurs when the hydraulic capacity of a combined sewer is exceeded during a rainstorm event, resulting in the combined discharge of wastewater and stormwater to a receiving body of water. Lynn has several CSOs, one of which (CSO #003) discharges to the Saugus River. To comply with the CWA, the Lynn Water AND Sewer Commission (LWSC) and the Environmental Protection Agency (EPA), entered into a Modified Consent Decree on November 2, 1987 (amended February 8, 1995).

To reduce the possibility of discharges at CSO #003, the Modified Consent Decree established a schedule to "detect and eliminate inflow from the sump pumps, roof drains, and other non-sewage inflow into the sewer collection system" in the Cottage Street and Summer Street Tributary Areas (CSTA & SSTA) (see Figure 1). The Consent Decree schedule requires LWSC to begin implementing a program to reduce inflow by March 1, 1998, and complete implementation of the program by December 31, 2004. An inflow detection program was conducted between March 1997 and December 1997 to identify inflow sources within the CSTA & SSTA in accordance with the terms and conditions of Task I of the Agreement dated April 24, 1997 between the LWSC and Camp Dresser & McKee Inc. (CDM).

Purpose

This report summarizes findings of the inflow detection program performed by CDM on the CSTA & SSTA wastewater collection systems, identifies locations of inflow sources, estimates the quantity of inflow and makes recommendations for future action which the LWSC must undertake to meet the requirements of the Consent Decree.

Inflow is stormwater runoff entering the sewer system, either by a direct or indirect connection. Direct inflow sources are actual piped connections, such as storm drain to sewer connections, whereas indirect sources are primarily associated with physical defects in the sewer pipeline and appurtenances. Inflow is also defined on the basis of whether the source is either public or private. Public sources of inflow include catch basins or drains on public property which are connected to the sewer. Private inflow sources include sump pumps, roof drains, driveway drains and yard drains which discharge to the sewer system.

The presence of inflow decreases the available capacity of a sewer system to convey wastewater and increases the operation and maintenance (O&M) costs of pumping stations and treatment facilities. Removal of inflow sources will decrease the frequency and volume of CSOs.

The scope of the inflow detection program included:

- A house-to-house investigation with a target of inspecting a minimum of 2,160 buildings (80 percent of 2,700 buildings).
- Smoke testing of up to 143,000 linear feet of the sewer system.
- Dyed water testing and tracing with television (TV) inspection of up to 200 inflow sites.
- A workshop to develop a private inflow reduction plan.

The inflow detection program complied with the Massachusetts Department of Environmental Protection (DEP) Guidelines for performing Infiltration/Inflow (I/I) Analyses and Sewer System Evaluation Surveys (SSES) (1993).

The inflow detection program conducted by CDM, with subconsultant services provided by Vermont Pipeline Services (VPS), consisted of a house-to-house investigation, smoke testing and a dyed water flooding and testing program. The actual program exceeded the contract goals for each program. The completed programs included entering in excess of 2,400 buildings to identify private sources of inflow, smoke testing of approximately 151,600 linear feet of sewer pipeline to identify potential public and private inflow sources, and dyed water flooding and testing of approximately 200 suspected inflow sources to confirm direct and indirect sources of inflow. Smoke testing and rainfall simulation investigations (dyed water flooding and testing) were performed from July through September of 1997, a low groundwater period. The data collected from these investigations was used during the design of the combined sewer separation construction contracts for the SSTA & CSTA and will provide the basis for continuing efforts by the LWSC to reduce private source inflow.

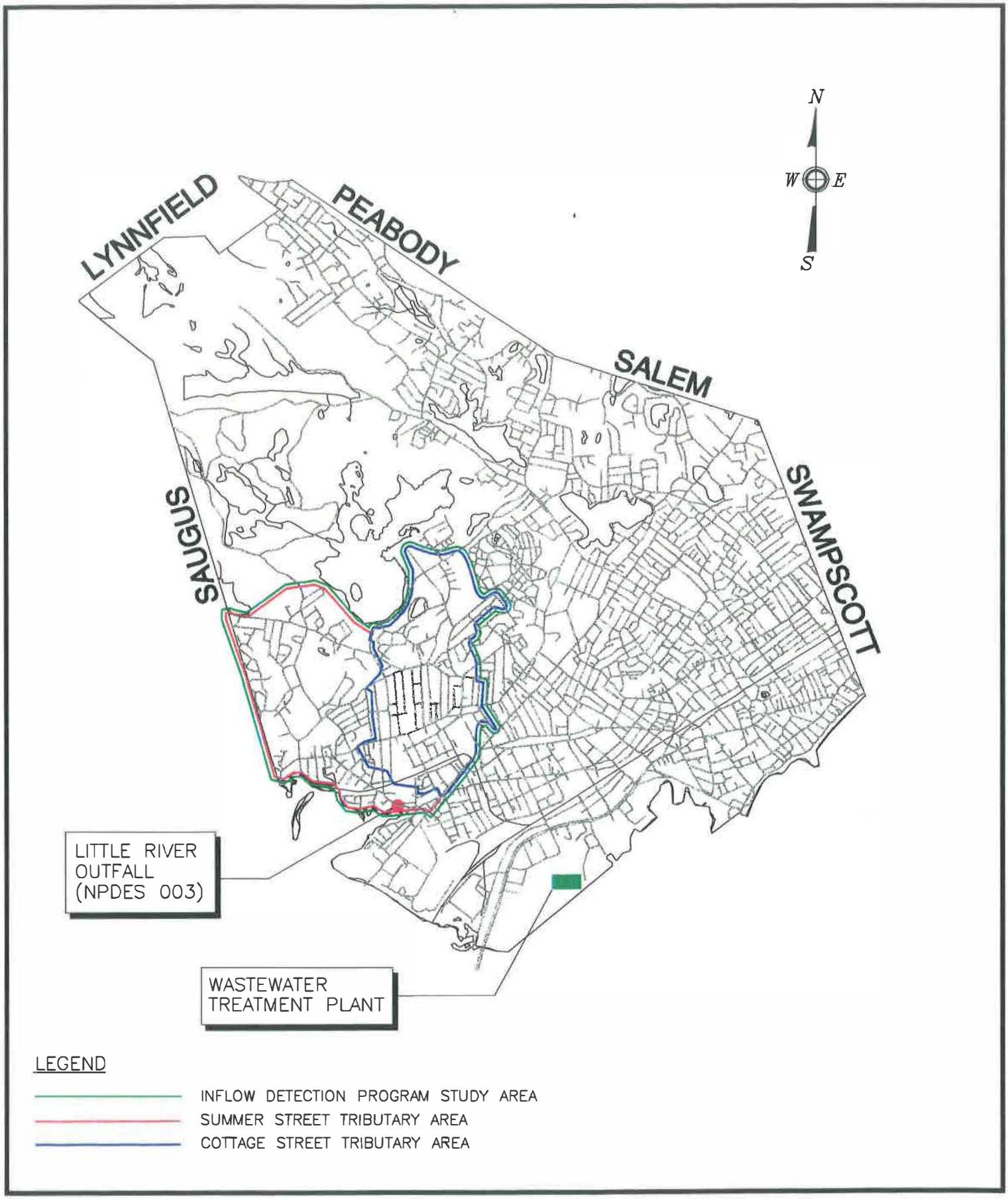
Study Area

The study area is comprised of the wastewater collection system tributary to the Western Interceptor upstream of CSO #003 referred to as the Summer Street Tributary Area (SSTA), and downstream of CSO #003 referred to as the Cottage Street Tributary Area (CSTA). The limits of the SSTA & CSTA (approximately 546 acres total) are shown in Figure 1. CSO #003, located in West Lynn on Summer Street, discharges to the Little River, a short tributary 1,500-feet long which drains to the Saugus River.

The portion of the study area within the SSTA primarily consists of separated systems of sanitary sewers and storm drains, while the CSTA is essentially comprised of a combined sewer system where both stormwater and wastewater are conveyed in a common pipe to the wastewater treatment plant.

Related Projects

In addition to mandating an inflow detection and disconnect program, the Modified Consent Decree established a schedule for the design and construction of the Summer Street and Cottage Street Sewer Separation Project, as described in *"Summer & Cottage Streets Combined Sewer Separation Project Draft Preliminary Design Report"* (CDM, November 1997). This project will to a large degree



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Lynn Water and Sewer Commission
Summer and Cottage Street
Inflow Detection Program

SCALE: 1" = 4000'

2000 0 4000

CDM Camp Dresser & McKee

Figure 1
Project Locus

eliminate all sources of public inflow in the SSTA and a significant portion in the CSTA with the minor exception of small areas specifically excluded from the proposed separation project as identified in the *"Combined Sewer Overflow Facilities Plan Phase II Report"* dated March 1990 (Facilities Plan). The Design Report incorporates the results of the inflow detection program.

CDM has been conducting a SSES in West Lynn since 1994. The SSES includes groundwater monitoring, continuous flow gauging, flow isolation, television inspection, and manhole inspections of the wastewater collection system. The SSES has been conducted in two phases, where Phase I investigations were initiated in 1994 and Phase II in 1997. The Phase I investigation results are presented in the report titled *"Infiltration/Inflow Analysis of the Western Interceptor Tributary Area Final Report"* (CDM, June 1995). Design and construction of the Phase I rehabilitation recommendations are scheduled to be completed in 1998. Phase II investigations results are presented in the report titled *"Western Interceptor Collection Sewers Sewer System evaluation Survey (SSES) and Infiltration/Inflow (I/I) Sewer Rehabilitation Report"* (CDM May 1998). It is our understanding that design and construction of the Phase II rehabilitation recommendations are scheduled to be completed in 1999.

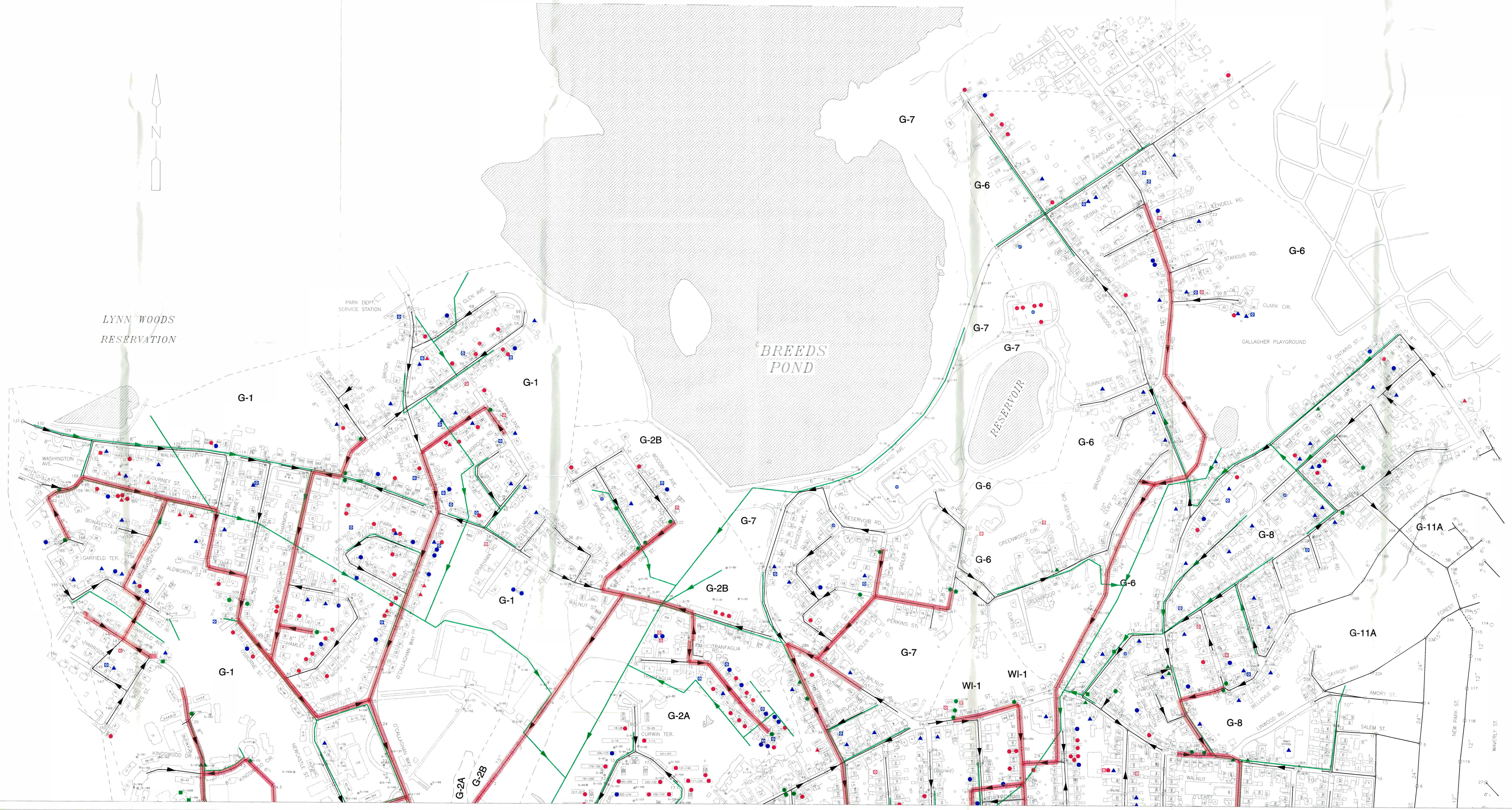
Inflow Investigation

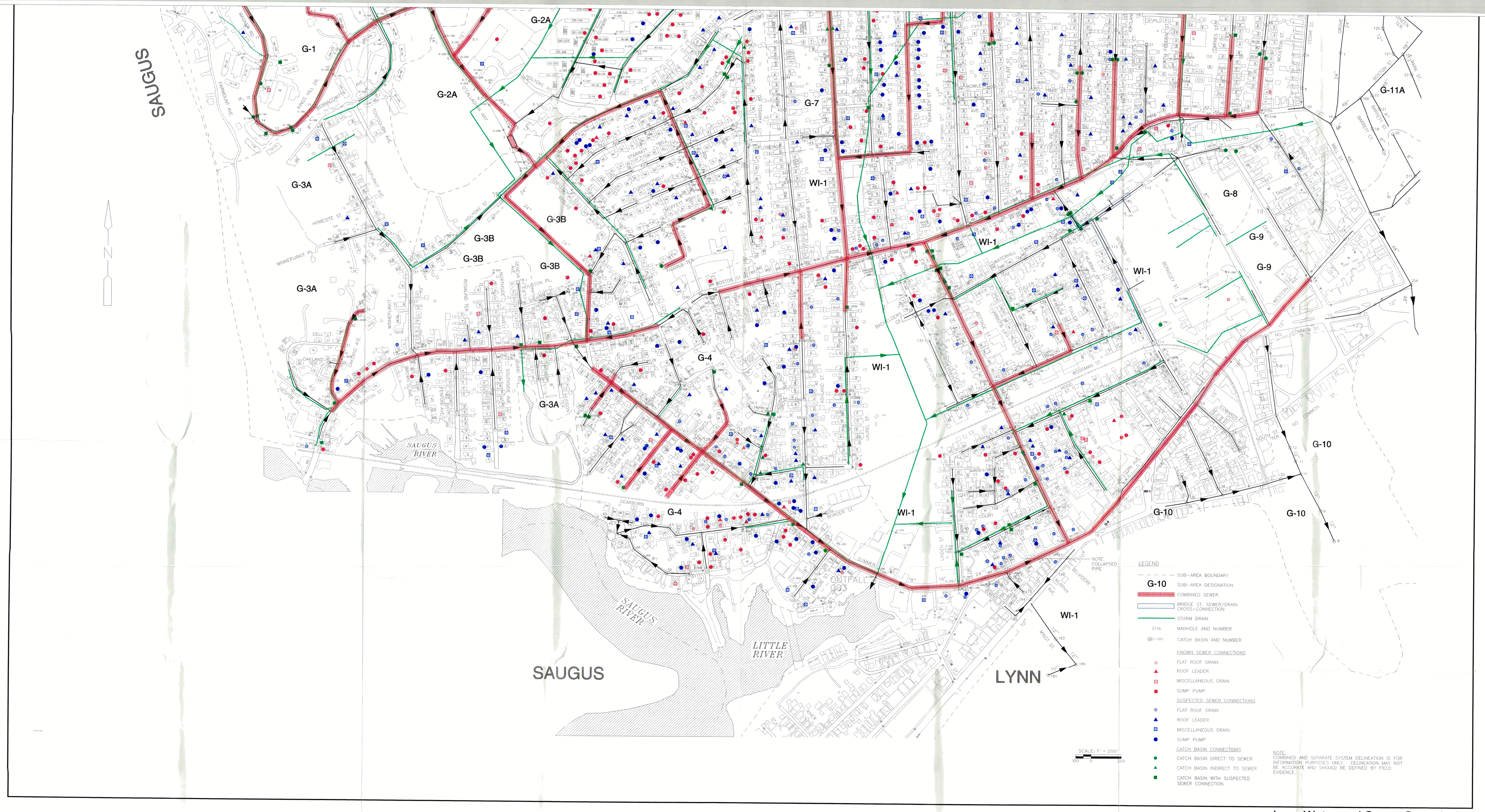
The main components of the inflow investigation were the house-to-house investigation, smoke testing, and dyed water flooding/testing. A description of each program is presented herein. The information compiled in each program forms the basis of the findings which are summarized on Figure 2 titled *"Inflow Detection Program Summary."*

House-to-House Investigation

Prior to initiation of the house-to-house investigation, property owners were notified of the planned inspections and the intent of the program through the local newspaper, public access television, and a mailing. The notice informed owners that inspectors would display proper photo identification to verify his or her authenticity as an inspector working on behalf of the City. The inspectors made two separate attempts to enter a building. If a building was not inspected on the second "visit," the inspector left an Appointment Card for the resident to call a hotline number to make an appointment to have their building inspected.

The goal of the house-to-house investigation was to gain entry to approximately 2,160 buildings (80 percent of 2,700) reported to exist within the study area. The actual number of buildings determined to exist within the study area and which were included in the investigation was approximately 3,230 buildings. CDM completed inspections of over 2,400 buildings, or 75 percent of all buildings in the study area. This represents a 15 percent increase over the intended program goal. A list of buildings for which CDM could not obtain entry after at least two visits is provided in Appendix A. For the house-to-house investigation, CDM inspection teams investigated both the internal plumbing and external grounds immediately surrounding each building and made notes of any potential inflow sources on an Inflow Inspection Sheet. A blank Inflow Inspection Sheet is presented in Figure 3.


LYNN WOODS RESERVATION
BREEDS POND
RESERVOIR
PARK DEPT. SERVICE STATION
GALLAGHER PLAYGROUND
CLARK CIR.
CURWIN TER.
G-1
G-2A
G-2B
G-6
G-7
G-8
G-11A
WI-1
WASHINGTON AVE.
WALNUT ST.
JOURNEY ST.
BONAVISTA TER.
GARFIELD TER.
ALDWORTH ST.
HAMLEY ST.
HARRIS ST.
OSBORNE ST.
KINGSWOOD DR.
NORMSTILE ST.
O'CALLAGHAN WAY
GLEN AVE.
GLEN TER.
MEADOW BROOK RD.
GALWAY LANE
SPARHAWK ST.
WOODBURY AVE.
SPRUCE ST.
TRANFAGLIA RD.
PARKLAND AVE.
RESERVOIR RD.
SADLER ST.
PERKINS ST.
GREENWOOD CIR.
GREENWOOD AVE.
LINWOOD ST.
BRADFORD TER.
SUNNYSIDE RD.
PRUDENCE RD.
DEBRA LN.
STANGUS RD.
FARWELL RD.
QUEBEC CT.
ONTARIO ST.
EVERETT ST.
LOCUST LEAF AVE.
WOODLAWN ST.
FOREST ST.
GAYRON WAY
AMORY ST.
SALEM ST.
BELLEVUE RD.
NEW PARK ST.
WAVERLY ST.
WALNUT
O'LEARY



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CDM Camp Dresser & McKee

Lynn Water and Sewer Commission
Summer and Cottage Street
Combined Sewer Separation Project

Figure 2
Inflow Detection Program Summary

LYNN WATER & SEWER COMMISSION

House to House Inspections
Inflow Inspection Sheet

Figure 3
Spring 1997

Inspectors _____

Address _____

Owner _____

Phone _____

Date _____ Sewer _____ Suspect _____

Entry Allowed by: ☐ Teen ☐ Renter _____
☐ Owner ☐ Other _____

Special Needs _____

Language (if not English) _____

EXTERIOR INSPECTION

1. House Lot Topography

Level	☐
Slope down to street	☐
Slope down to house	☐
High groundwater	☐
Brook on property	☐
Wetlands	☐
Ledge	☐
Pond	☐
Lake	☐

2. Roof Leader Discharge
(indicate # of roof leaders)

To ground	_____
To sewer	_____
To dry well	_____
To catch basin	_____
Undetermined	_____
Per owner	☐

3. Drains

Sidewalk	☐	To ground	☐
Driveway	☐	To sewer	☐
Yard	☐	To dry well	☐
Patio	☐	To catch basins	☐
Stairwell	☐	Undetermined	☐
Window	☐	Per owner	☐
Bulkhead	☐		
Garage	☐		

4. Special Conditions
(drain easements, road conditions)

_____

_____

_____

5. Flat Roof ☐ Yes ☐ No

Number of roof drains _____

Use sketch to locate:

D	drains	⊞	catch basins
P	sump pump with discharge location	D	suspect/connected drain
		P	suspect/connected sump pump

INTERIOR INSPECTION

1. Basement Flooding

Inches on wall	_____
Floor wet	☐
Floor damp	☐
Floor dry	☐
Finished cellar	☐
Cement floor	☐
Dirt floor	☐

2. Floor/foundation drains

Floor	☐
Perimeter	☐
To ground	☐
To sewer	☐
To dry wall	☐
To catch basin	☐
Undetermined	☐
Per owner	☐

3. Main Sewer Pipe/ Cleanout

Inches above floor	____
Inches below floor	____
At floor level	☐
Sewer back-ups	☐
Clean-out cap on	☐
Clean-out cap off	☐
Other connection	☐

4. Sump/Submersible Pump Discharge

Sump pump (#)	_____
Make	_____
GPM ____ TDH	____
Sump hole only	☐
Wet vac used	☐
Portable/utility	☐
To ground	☐
To sewer	☐
To dry wall	☐
To catch basin	☐
Undetermined	☐
Per owner	☐

Notes to Inspectors:

1. Explain illegal and suspect connections and all serious groundwater conditions on back side.
2. Check for basement plumbing. Is it used frequently? ☐Yes ☐No
   If no, obtain permission to run and explain proper maintenance (regular running to prevent traps from drying out).

The house-to-house investigation identified the following sources of inflow:

- Sump pumps.
- Flat roof drains.
- Pitched roof downspouts.
- Yard drains, driveway drains, and miscellaneous private drains.

During the investigation, an attempt was made to visually identify the point of discharge for each source of inflow. If the discharge was to a direct connection to the building sewer service connection, the inflow source was confirmed as a direct connection. If the discharge was determined to be directed to the ground surface, it was confirmed not to be connected, and therefore not a source of inflow. If the discharge location could not be determined by the inspector, it was recorded as a "potential" source of inflow to be confirmed either through smoke or dyed water testing.

Smoke Testing

Smoke testing is a useful economic procedure used to locate potential sources of inflow to the sewer system. Smoke testing of sewer pipelines is accomplished by blowing smoke from a smoke bomb or liquid smoke into an isolated reach of the sewer system at a manhole(s) for a period of 5 to 10 minutes. Smoke completely fills the isolated section of the sewer, including intermediate manholes, lateral sewers and house connections. Potential inflow sources are identified by the escape of smoke from the isolated sewer reach.

Smoke testing detects the following sources of inflow:

- Defects in a sewer pipeline which permit stormwater and groundwater to enter the sewer system.
- Roof, cellar, yard and driveway drains connected to the sewer system.
- Catch basins connected to the sewer system.
- Cross-connections between storm drains and sewer pipelines.
- All connected pipes with open ends, such as abandoned service connections, open cleanout plugs, broken pipes, etc.
- Leaking manholes.

Smoke testing may also identify internal house plumbing deficiencies, such as poorly soldered joints and/or poorly fitted joints or seals, and dry plumbing traps. These deficiencies may allow noxious gases to enter a building resulting in a potential public health hazard.

Prior to smoke testing, the public was notified by newspaper articles and notices were hand delivered to each building adjacent to the sewers to be tested. The Lynn Police and Fire

Departments were informed of the program and were notified daily of the streets where smoke testing was scheduled to be performed.

The initial findings of the smoke testing program are included in the report titled *"Lynn Smoke Testing, Summer 1997"* prepared by Vermont Pipeline Services. Subsequent to smoke testing, CDM engineers performed field inspections to confirm the smoke emanation locations as direct inflow sources. For public inflow sources if the local sewer system was reported to be combined, smoke at catch basins was expected to occur. However, where separate sewer and drainage systems were reported, smoke at catch basins was an indication of either a direct or indirect inflow source. In many cases a visual inspection of the catch basin was sufficient to confirm a direct connection to the sewer system. Where a visual inspection was not sufficient to confirm a connection, dyed water testing and flooding was performed within the limitations of the dye flooding and testing program (only 200 sites were included in the scope). A representative number of the catch basins which could not be confirmed by visual inspection were selected for the dye testing program. Where smoke emanations were reported for private inflow sources, these locations were inspected during the house-to-house inspection program.

Dyed Water Flooding and Tracing

Dyed water flooding and testing is a procedure used to confirm potential sources of inflow to the sewer system, initially identified by the smoke testing program and not subsequently confirmed by visual inspection. Dyed water testing of potential inflow sources is conducted by first observing the flow within the section of sanitary sewer at a manhole located downstream of the suspected inflow source. After dyed water is added to the potential source, the observation of an increase in flow accompanied by the presence of dyed water is confirmation of an inflow source.

A second method, dyed water flooding, is employed when section(s) of the sewer system are suspected of having interconnections with the storm drainage system. In this case, the storm drain is plugged at a point downstream of the suspected interconnection prior to the introduction of dyed water into the drain. If interconnected, the surcharged condition in the storm drain creates an inflow of dyed water to the adjacent sanitary sewer. Flow measurements and visual observation of conditions prior to and during the flood test are used to determine the extent of the inflow source.

Closed-circuit television inspection was also used in conjunction with the dyed water flood test to inspect the adjacent sanitary sewer line to identify any connections or sources of infiltration located within the sewer pipe.

Dye testing of suspect public inflow sources was prioritized to provide information required for the SSTA & CSTA Combined Sewer Separation Project. In some areas, dye testing was utilized to resolve conflicting information such as when a local sewer system was reported to be combined; however, no catch basins smoked during smoke testing. Dyed water testing indicated whether the catch basins in question simply had a trap that prevented it from smoking, or the sewer system was in fact separated and the catch basin was connected to a drain.

Inflow Investigation Results

Inflow investigation results are presented below for both public and private inflow sources. The inflow investigations conducted in the SSTA & CSTA confirmed 473 inflow sources to the sewer system, of which 417 were private sources and 56 were public sources. The locations of all confirmed and suspected (discharge location not confirmed) inflow sources are presented in Figure 2.

Public Inflow Sources

Investigations to locate potential public inflow sources (i.e., catch basins) were conducted in areas where the sanitary sewer and drainage systems were reported to be separated. First smoke testing was used to identify catch basins which were suspected to be connected to the sanitary sewer rather than the local drain. Connections were subsequently confirmed either by visual inspection or by the use of dyed water testing /flooding. A total of 116 catch basins were identified as direct, indirect or suspect connections to the sanitary sewer systems within the SSTA & CSTA. Of these, 13 catch basins are located within Kings Lynne Housing Development which is a privately owned property. These have been included for discussion below under Private Inflow Sources. Of the 103 catch basins included in the public inflow category, 56 catch basins were confirmed as directly connected to the sewer system and 17 indirectly connected to the sewer system. The remaining 30 catch basins are suspected as being directly connected on the basis of smoke testing but have not been confirmed by dye water flooding/testing as either direct or indirect sources of inflow. All catch basins which were either confirmed or suspected to be connected to the sanitary sewer system are shown on Figure 2.

In addition to smoke testing and dyed water flooding/testing, internal television inspection was performed on approximately 2,000 linear feet of sewer pipe and about 6,900 linear feet of storm drain. The results of the sewer system television inspection program are summarized in Table 1 below. The recommended repairs at Ontario Street, Raddin Grove, and Walnut Street have been included in the "*Western Interceptor Collection Sewers SSES and I/I Report*" dated May 1998.

The recommendation to disconnect the 12-inch diameter sewer from Strawberry Brook culvert was previously forwarded to the LWSC by CDM letter dated November 5, 1998. LWSC has reported that the 12-inch diameter pipe was determined to be a high level overflow connection from manhole located at the upstream end of a sewer siphon passing under Strawberry Brook. The piped overflow between the local sewer and the drain has been removed by LWSC forces.

The recommendation to delay action on eliminating the interconnection between Strawberry Brook culvert and the Cottage Street sewer, is allow future evaluation of the need for hydraulic relief of the Cottage Street sewer after completion of LWSC Construction Contract No SS-8. Total separation of the combined sewer systems within the Cottage Street sewer tributary area will not be accomplished by Construction Contract SS-8. Wastewater collection systems will remain combined in Carnes Street, Hurd Street, and Sadler Street as reported by CDM letter dated January 7, 1998. Additional flow gauging/monitoring is recommended to be performed after the sewer separation projects have been completed to determine if the relief connection is still required to prevent surcharging of the Cottage Street sewer during rain events.

Table 1
Wastewater Collection System
Television Inspection

Location	*Pipe Size*	*Length of Pipe*	*Findings*	*Recommendations*
Ontario Street	8-inch	1,257 linear feet	Major infiltration problems exist, especially at the joints.	Repair joints and cracked pipe.
Raddin Grove Avenue	8-inch	416 linear feet	A poor connection is a major source of infiltration.	Repair connection.
Bridge Street	12-inch	62 linear feet	The sewer is directly connected to Strawberry Brook. All catch basins in Bridge Street/Waterhill Street area are connected to the sewer.	Disconnect sewer from Strawberry Brook. Construct a separate drain for the catch basins.[1]
Walnut Street/ North Federal Street	12-inch	62 linear feet	Leakage around a capped cross-connection is a source of significant infiltration.	Repair cap.
Cottage Street	2-feet by 3-feet	203 linear feet	A cross-connection exists between Strawberry Brook and Cottage Street sewer.	Block cross-connection after completion of SS-8.

[1]LWSC forces have completed this repair.

A summary of the drainage system television inspection logs is included in Table 2. The videotapes and inspection logs will be furnished separately.

Private Inflow Sources

Private source inflow occurs from the discharge of sump pumps, downspouts, and yard drains of buildings and properties which either directly or indirectly discharge to the LWSC sewer system. Inflow also results from catch basins within private developments.

At the start of the study, CDM was informed that the Curwin Circle wastewater collection system was a combined system and Kings Lynne system was separate. Based on smoke testing and subsequent dyed water flooding/testing, CDM determined that the Curwin Circle system is comprised of separate sewers and drains. The catch basins in this development are correctly connected to the local drainage system. At Kings Lynne, smoke testing showed that although the sanitary and stormwater drainage systems are separate, direct and indirect inflow from catch basins occurs at several locations shown on Figure 2.

Table 2
Stormwater Collection System
Television Inspection

Location	*From*	*To*	*Pipe Size (in)*	*Length (ft)*	*Observation*
Birch Brook	Sigorney St.	Sterling St.	36	189	Heavy debris
Birch Brook	Sterling St.	Harmon St.	36	248	Heavy roots and debris
Birch Brook	Harmon St.	O'Callaghan Way	36	612	Heavy debris, buried manhole
Birch Brook	Behind Breed Junior H.S.	O'Callaghan Way	48	299	Heavy debris
Birch Brook	Behind Breed Junior H.S.	Parking lot	48	471	Heavy sand
Hood Street	Cottage St.	Spencer St.	15	761	3 cracked bells, heavy debris
O'Callaghan Way	Osborne St.	Moores Brook	24	1,369	Broken pipe from Sta 2+35 to Sta 2+45
Stoney Brook	Childs St.	Flint St.	36 x 48	386	Heavy debris
Stoney Brook	Flint St.	York St.	36 x 48	206	Heavy debris, hole in culvert crown
Stoney Brook	York St.	Wyman St.	36 x 48	226	Heavy debris
Stoney Brook	Wyman St.	Blakely St.	36 x 48	120	Heavy debris
Stoney Brook	Blakely St.	Newton St.	36 x 48	178	Heavy debris
Stoney Brook	Newton St.	Woodbine St.	36 x 48	145	Heavy debris, 3 holes culvert crown
Stoney Brook	Mildred St.	Boston St.	36 x 48	623	Heavy debris, multiple cracks, 2 holes in culvert crown
Strawberry Brook	Stoney Brook	Summer St. Outfall	60 x 72	1,086	2-24" pipes entering from Boston St filled with sand

A summary of all other potential and confirmed private inflow sources identified during the house-to-house inspection program, and the smoke testing and dyed water testing investigations is given in Table 3 below:

Table 3
Private Inflow Investigation Summary

Inflow Source	*Total Number Observed*	*Confirmed Directed to Ground/ Storm Drain*	*Confirmed Directed to Sewer[1]*	*Remaining Unconfirmed Sources[2]*	*Total Confirmed Connections*
Sump Pumps	585	254	258	73	512
Flat Roofs	156	45	19	92	64
Roof Leaders	9,644*	8,808	104	732	8912
Miscellaneous Drains	176	51	36	89	87
Total	10,561	9,158	417	986	9575

[1]Shown on Figure 2 in Red.
[2] Shown on Figure 2 in Blue.
*Assuming 4 downspouts per house at 2,411 houses = 9,644 downspouts.

If the remaining 986 unconfirmed private inflow sources are distributed in the same ratio as the confirmed sources, a potential estimate of the additional private inflow sources may be made as shown in Table 4.

Table 4
Estimated Additional Private Inflow Sources

Inflow Source	*Estimated Additional Directed to Ground/Storm Drain*	*Estimated Additional Directed to Sewer*	*Estimated Total Additional to Ground/Storm Drain/Sewer*
Sump Pumps	36	37	73
Flat Roof	65	27	92
Roof Leaders	723	9	732
Miscellaneous Drains	52	37	89
Total	876	110	986

The location of buildings included in the house-to-house inspection program (Table 3) were either confirmed or unconfirmed direct sump pump connections to the sewer system are shown on Figure 2. The figure graphically presents the distribution of sump pump locations throughout the study area and will be beneficial in developing a sump pump disconnect program. Confirmed sources shown in red on Figure 2, include all locations where the sump pump discharge location could be

verified by either a CDM inspector or by the owner of the property. Unconfirmed sources shown in blue on Figure 2, include locations where a sump pump discharge location could not be verified by either a CDM inspector or owner, and is potentially connected to the sewer system.

Inspection of building drainage systems for flat roof buildings was limited because in most cases access to the roof was not allow for safety reasons. However, where possible, inspection of the building internal plumbing was performed to determine if the roof area was piped to the building sewer service connection. Visual inspection of the building exterior was also performed to note the number and discharge location for downspouts. If the downspout discharged to ground, it was so noted. It should be pointed out that if the local collection system in the area of the building is a combined system, there is a possibility that roof drainage discharged to the ground surface may enter the sewer system as an inflow source. At locations where the downspout discharges to a piped connection into the ground, an effort was made to determine if the pipe returned into the building's internal plumbing or to a dry well. The results of these investigations are also shown on Figure 2 coded red for confirmed and blue for potential connections.

In addition to sump pumps and downspouts, miscellaneous drains on private property are potential sources of inflow. Such drains may serve low lying backyard, driveway, garage, and basement areas. The location of properties where private drains were visually inspected and dye water tested to determine their point of discharge are also shown on Figure 2.

Although the house-to-house inspection program did not include all the 3,230 buildings within the SSTA and the CSTA, the survey of private inflow sources provides a comprehensive look at the distribution and types of sources which exist. This information can be used in the development of public policy needed to institute a program to eliminate the major sources of private inflow and to prioritize which sources to address first.

Evaluation of Inflow's Impact on System Operation

Inflow decreases the available capacity of the sewer system for handling wastewater flows and increases the operation and maintenance (O&M) costs of pumping stations and wastewater treatment facilities. Removal of inflow sources will decrease the average daily wastewater flow rate and will result in cost savings. However, the main reason for identifying and removing inflow sources is to eliminate overflows at CSO #003, a requirement of the Modified Consent Decree. Overflows occur at this location during periods of rainfall when runoff enters the wastewater collection system tributary to the Summer Street sewer and the combined wastewater flow rate exceeds the capacity of the sewer system downstream of the overflow connection to CSO #003.

The public component of inflow will be significantly reduced upon completion of LWSC Construction Contract Nos. SS-7 & SS-8. Essentially all existing catch basins currently connected to the sanitary sewer system will be redirected to the stormwater collection system. Therefore, only private source inflow will remain connected to the Summer Street sewer upstream of Outlet #003. However because of the limiting capacity of the existing 18-inch sewer in Summer Street immediately downstream of the overflow connection to CSO #003, an analysis of the capacity of the Summer Street sewer was performed to determine if elimination of private source inflow is needed

to minimize overflows at this location. The results of this study were submitted to the LWSC by CDM letter dated February 5, 1998 (Appendix B).

The report presents two alternatives to reduce or eliminate overflows at CSO #003. They include either replacing the 18-inch diameter section of the Summer Street sewer with a 24-inch diameter pipe and transporting and treating private inflow; or implementing a program to eliminate sump pumps and downspouts. Based on a cost-effectiveness evaluation of each alternative, a recommendation was made to implement a voluntary program to disconnect sump pumps and downspouts. The Disconnect Program is discussed in detail hereinafter. The program was to be conducted coincident with the combined sewer separation construction contracts in the SSTA & CSTA. The recommendation also suggested priority for sump pump removal in the SSTA.

Additionally, smoke testing revealed potential infiltration (indirect sources) that may be entering the sewer system through poor pipe joints or cracked pipe. Information on infiltration locations discovered during the inflow detection program were reported in the *"Western Interceptor SSES and I/I Report"* dated May 1998.

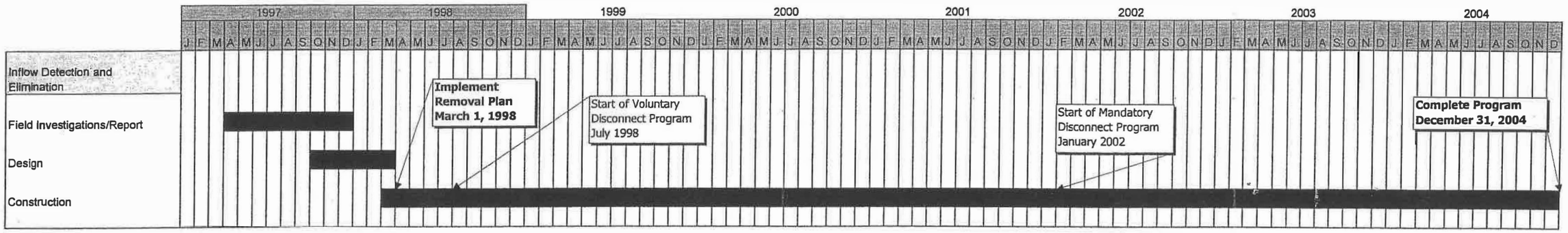
Disconnect Program

In conjunction with the investigations conducted to locate and confirm sources of inflow, CDM worked closely with the LWSC to develop a strategy on how to effectively accomplish the goal of eliminating private inflow sources. During an Inflow Reduction Workshop held on October 2, 1997, a range of disconnect/redirect alternatives were discussed. LWSC and staff determined that the most effective and appropriate way to achieve the maximum number of disconnections at the least cost to ratepayers would be a Disconnection Program that has both voluntary and mandatory components. The property owner would be given a "grace" period with reimbursement or subsidy for disconnecting voluntarily. This phase would be followed by a mandatory period with no reimbursement or subsidy, and then fines would be assessed through enforcement of the sewer regulations. A schedule of the Disconnect Program is shown in Figure 4.

On February 9, 1998, the Commission voted to implement the recommended program, providing full reimbursement for work performed, with the stipulation that costs over $500 require two or three estimates.

The Disconnect Program is for the SSTA & CSTA, as defined in the Modified Consent Decree, however, it should be noted that the disconnection program within the SSTA is critical since this area is located above CSO #003. The Policy is directed at all downspouts which are directed into the ground and all sump pumps connected or "suspected" connected to the sewer. A sump pump will be considered disconnected if it is hard-piped out of the basement to the ground, the street, or directly to the drain. A downspout will be considered disconnected if it does not go into the ground or if it is dye tested and proven to go to a dry well. Sump pump removal should be given first priority.

CDM has determined from the Massachusetts Department of Environmental Protection (MDEP) that the sump pump and downspouts removal costs incurred by the LWSC are not eligible for State Revolving Fund (SRF) funding.



Consent Decree Required Milestones are shown in bold on the schedule

Figure 4
Preliminary Schedule for Inflow Detection and Disconnection

Appendix A

Houses Not Entered

Houses Not Entered

	ADDRESS		NOTES
	26	ABBOTT ST	
	29	ABBOTT ST	
	39	ABBOTT ST	
	46	ABBOTT ST	
	2	AGGANIS SQ	VACANT - CARLSON RE - 598-4820
	9,11	AGGANIS SQ	NO BASEMENT - VACANT
	6	AINSWORTH PL	SAYS HAS BEEN DONE
	14	ALBION ST	
	22	ALDWORTH ST	
	24	ALDWORTH ST	
	32	ALDWORTH ST	
	4	ALDWORTH ST	CALL FOR APPT. (617) 595-6289, Joseph Twomey
SS-8	24	AMES ST	MAKE APPT
SS-8	5	AMES ST	
SS-8	32	ARTHUR ST	RHEUME - 2 NOT HOME
SS-8	34	ARTHUR ST	2 NOT HOME
SS-8	9	ARTHUR ST	2 NOT HOME
SS-8	102	ASHLAND ST	
SS-8	105	ASHLAND ST	CALL FOR APPOINTMENT, (617) 595-0195
SS-8	109	ASHLAND ST	
	27	ASHLAND ST	
	5	ASHLAND ST	
	64	ASHLAND ST	
	80	ASHLAND ST	
	86	ASHLAND ST	
SS-8	88	ASHLAND ST	
SS-8	89	ASHLAND ST	
SS-8	92	ASHLAND ST	
SS-8	98	ASHLAND ST	
	14	ATKINSON ST	Resident refused entry.
	15	ATKINSON ST	
	18	ATKINSON ST	
	24	ATKINSON ST	
	33	ATKINSON ST	
	2	AUSTIN SQ	
	16,20	AVON ST	
	18	B ST	2 NOT HOME
	26	B ST	NORMA KROL 592 - 1044 CALL FOR APPT

ADDRESS		NOTES
11	BATCHELDERS CT	
19	BATCHELDERS CT	
12	BELLE AVE	
29	BELLE AVE	
30	BELLE AVE	DENIED ACCESS - DOESN'T WANT APPT EITHER
5,7	BELLE AVE	
8	BELLE AVE	MAKE APPT
45	BELLEVUE RD	
51	BELLEVUE RD	
56	BELLEVUE RD	
65	BELLEVUE RD	
84	BELLEVUE RD	MAKE APPT. JOE FALLON 596-0024
87	BELLEVUE RD	
12	BELMONT AVE	
33	BELMONT AVE	
35	BELMONT AVE	
38	BELMONT AVE	
4	BELMONT AVE	
6	BELMONT AVE	
62	BELMONT AVE	
66	BELMONT AVE	
12	BLAKELEY ST	2ND NOT HOME
16	BLAKELEY ST	2ND NOT HOME
38	BLAKELEY ST	2ND NOT HOME
73	BLAKELEY ST	
76	BLAKELEY ST	2ND NOT HOME
88	BLAKELEY ST	ELDERLY WOMAN VERY SICK AND DID NOT ALLOW ACCESS.
11	BONAVESTA ST	2 ND NOT HOME
30	BONAVESTA ST	2ND NOT HOME
23	BONAVESTA TER	2 ND NOT HOmE
0	BOSTON ST	SUNSHINE LAUNDRY
423	BOSTON ST	1/2 BUILDING VACANT (1/2 OCCUPIED WAS ENTERED)
450	BOSTON ST	VACANT
479	BOSTON ST	Basement locked. Resident will give card to owner.
483	BOSTON ST	
505	BOSTON ST	abandoned bld'g.
533	BOSTON ST	Randy Boyce - Owner 596-0762 (per resident) basement is a private ap't.
613,615	BOSTON ST	PART VACANT
631	BOSTON ST	BILL CHAPDELAINE 233-5946 NOT BTWEEN 3-11 pm
634	BOSTON ST	

	ADDRESS		NOTES
55-7	639	BOSTON ST	
55-8	643	BOSTON ST	
55-8	660	BOSTON ST	
55-8	664	BOSTON ST	MAKE APPT
	666	BOSTON ST	
	670	BOSTON ST	CALL FOR APPT. TENANTS MOVING
	687	BOSTON ST	MAKE APPT. 593-3154
	690	BOSTON ST	
	692	BOSTON ST	
	696	BOSTON ST	
	711	BOSTON ST	
	733	BOSTON ST	
	734	BOSTON ST	
55-8	771	BOSTON ST	MAY NEED APPT
55-8	779	BOSTON ST	
55-8	789	BOSTON ST	
55-8	820	BOSTON ST	LOCKED CALL LANDLORD
	10	BRADFORD TER	
	21	BRADFORD TER	ACCESS DENIED BY OWNER
	15	BROOKVALE ST	
	8	BROOKVALE ST	WORKS NIGHTS, GERRY KALAGRIDIS 599-1877
	11	BROWNS AVE	
	23	BROWNS AVE	
	30	BROWNS AVE	
	39	CATALINA RD	
	46	CATALINA RD	LANDLORD JOHN CARNEY (617)438-8288
	50	CATALINA RD	LANDLORD JOHN CARNEY (617)438-8288. SLAB FOUNDATION, NO OTHER ENTRIES ON THIS SHEET.
	52	CATALINA RD	SHE WILL MAKE APPOINTMENT. WON'T GIVE OUT PHONE #
	58	CATALINA RD	2ND NOT HOME
	12	CATALINA TER	
	7	CATALINA TER	
	9	CATALINA TER	
55-8	18	CHILDS ST	
55-8	25	CHILDS ST	2ND NOT HOME
55-8	40	CHILDS ST	LANDLORD NOT HERE, HE WILL CALL. LEFT CARD.
55-8	73	CHILDS ST	CALL FOR APPOINTMENT (617) 593-4862 Rachel Tose
55-8	91	CHILDS ST	2ND NOT HOME
	10	CLARK CIR	2 FAMILY HOME
	16	CLARK CIR	
	23	CLARK CIR	LEFT CARD. HE WILL CALL

ADDRESS		NOTES
34	CLARK CIR	
35	CLARK CIR	LEFT CARD. SHE WILL CALL
13	CLIFF ST	
112	COTTAGE ST	
116	COTTAGE ST	UNDER CONSTRUCTION. 598-4000
119	COTTAGE ST	CALL FOR APPT. LIVES IN SALEM
12	COTTAGE ST	
124	COTTAGE ST	
130	COTTAGE ST	
131	COTTAGE ST	
144	COTTAGE ST	
15	COTTAGE ST	
17	COTTAGE ST	
19	COTTAGE ST	2ND NOT HOME
23	COTTAGE ST	MAKE APPOINTMENT
24	COTTAGE ST	
25	COTTAGE ST	2ND NOT HOME
26	COTTAGE ST	MAKE APPT /LANDLORD
27	COTTAGE ST	2ND NOT HOME
28,30	COTTAGE ST	VACANT
33	COTTAGE ST	CALL LANDLORD PAUL EITHER 5960046 OR 48
39A	COTTAGE ST	
42	COTTAGE ST	
44	COTTAGE ST	
63	COTTAGE ST	
67	COTTAGE ST	DANNY MANSFIELD 596 - 1841 CALL FOR APPT
71	COTTAGE ST	ATTACK DOGS. NO ACCESS
75	COTTAGE ST	
77,79	COTTAGE ST	CALL LANDLORD FOR ACCESS. KEVIN FRENCH 508 -694 -9272
87	COTTAGE ST	
9	COTTAGE ST	2ND NOT HOME
23	COURT ST	
9	COURT ST	
9.5	COURT ST	
18	CURRAN RD	2ND NOT HOME
19	CURRAN RD	
37	CURRAN RD	CALL FOR APPT
57	CURRAN RD	
72	CURRAN RD	2ND NOT HOME
9	CURRAN RD	

ADDRESS		NOTES
319-321	CURWIN CIR	NO ACCESS.
63-65	CURWIN CIR	NO ACCESS. 6" OF WATER AT #63 END OF BUILDING.
75-77	CURWIN CIR	NO ACCESS
27-29	CURWIN TER	NO ACCESS.
13	DEARBORN AVE	
39	DEARBORN AVE	LEFT A CARD WITH RENTER
41	DEARBORN AVE	
78	DEARBORN AVE	2ND NOT HOME
81	DEARBORN AVE	SAID: "I DON'T HAVE TO LET YOU IN." LEFT HIM A CARD
89	DEARBORN AVE	
93	DEARBORN AVE	
11	DEBRA LN	595 -6571 ESTES. CALL FOR APPT
5	DEBRA LN	
7	DEBRA LN	Zboroski 598-9575 call for appt
15	DEER PK	MARIA FERNANDEZ: 598-4089
20	DEER PK	
6	DEER PK	
9	DEER PK	
11	DELL CT	
5	DREXEL TER	2ND NOT HOME
49	DUNGEON AVE	
53	DUNGEON AVE	HE SAID HE WILL CALL FOR APPOINTMENT
9,11	DUNGEON AVE	JUST LEAVING. GAVE HER CARD TO CALL
11,13	ECHO GROVE AVE	
15	ELIZABETH ST	CARD TO TEEN
18	ELIZABETH ST	
19	ELIZABETH ST	
35	ELIZABETH ST	
10	ETNA PL	2 not home
12	ETNA PL	2 not home
16	ETNA PL	2 not home
18	ETNA PL	Landlord has key. Left card with renter
30	ETNA PL	2 not home
30	FARRELL RD	
48	FARRELL RD	
80	FARRELL RD	
87	FARRELL RD	
0	FEDERAL ST	LIBERNIAN HALL DIV. 10
15	FEDERAL ST	call for appointment, Martinez
98	FEDERAL ST	

ADDRESS		NOTES
27	FENTON AVE	
29	FENTON AVE	
37	FENTON AVE	
40	FENTON AVE	
41	FENTON AVE	DOESNT EXIST
45	FENTON AVE	ON SEPTIC PER OWNER
7	FENTON AVE	
10	FLINT ST	Landlord, Bill Pierce, has key. He lives in Peabody.
103	FLINT ST	
112	FLINT ST	
12A, 12B	FLINT ST	2 not home
18,20	FLINT ST	
21	FLINT ST	
22	FLINT ST	
23	FLINT ST	
27	FLINT ST	
31	FLINT ST	
39	FLINT ST	
43	FLINT ST	
57	FLINT ST	
67	FLINT ST	
75	FLINT ST	
79	FLINT ST	
87	FLINT ST	
9	FLINT ST	
99	FLINT ST	
11	FULLER ST	
39	FULLER ST	
6	FULLER ST CT	
103	GARDINER ST	2 FAMILY HOUSE. 2ND NOT HOME
118	GARDINER ST	
12	GARDINER ST	2 NOT HOME
127	GARDINER ST	CALL (617) 595-2769 Dulong
32	GARDINER ST	
38	GARDINER ST	
39	GARDINER ST	OWNER NOT HOME. TEEN
52	GARDINER ST	2 NOT HOME
60	GARDINER ST	3 FAMILY HOUSE. 2 NOT HOME
69	GARDINER ST	2 NOT HOME
76	GARDINER ST	2 NOT HOME

ADDRESS		NOTES
90	GARDINER ST	2 NOT HOME
93	GARFIELD AVE	SHE WILL CALL FOR APPOINTMENT (617) 593-9312 BRENNAN
93A	GARFIELD AVE	2 NOT HOME
10	GARFIELD TER	2 ND NOT HOME
14	GARFIELD TER	2 ND NOT HOME
19	GARFIELD TER	DENIED ENTRY
28	GARFIELD TER	MAKE AN APPOINTMENT (617) 599-5350 BLUEFORT
40	GARFIELD TER	
42	GARFIELD TER	
26	GATEWAY LN	
3	GATEWAY LN	
33	GATEWAY LN	
37	GATEWAY LN	
47	GATEWAY LN	
63	GATEWAY LN	
14	GENEVA AVE	
2	GENEVA AVE	
3	GENEVA AVE	
6	GENEVA AVE	
11	GLEN AVE	
16	GLEN AVE	
19	GLEN AVE	TEEN AT DOOR. DIDN'T GO IN. WE TOLD THEM TO CALL
39	GLEN AVE	"CAN' T COME IN MY BASEMENT" BETTER CALL
14	GLEN TER	2 ND NOT HOME
6	GLEN TER	2 ND NOT HOME
17	HARMON ST	
45	HARMON ST	
83	HARMON ST	
80	HARRISON AVE	
82	HARRISON AVE	DENIED ENTRY
8	HART ST	2 not home
21	HESPER ST	
23	HESPER ST	
27	HESPER ST	
37	HESPER ST	
9	HESPER ST	
14	HOLLAND ST	APPARTMENTS, PERMISSION DENIED.
106	HOLYOKE ST	VACANT - CORNER REAL ESTATE (617)233-7060
111	HOLYOKE ST	WILL MAKE APPT
148	HOLYOKE ST	2 not home

ADDRESS		NOTES
156	HOLYOKE ST	2 not home
180	HOLYOKE ST	2 not home
194	HOLYOKE ST	2 not home
26	HOLYOKE ST	2 not home
48	HOLYOKE ST	
52	HOLYOKE ST	
55,57,59	HOLYOKE ST	WESLYN PARK
57/2	HOLYOKE ST	
57/3	HOLYOKE ST	
57/6	HOLYOKE ST	
6	HOLYOKE ST	2 not home
72	HOLYOKE ST	
76	HOLYOKE ST	
98	HOLYOKE ST	
14	HOMESITE ST	
15	HOMESITE ST	
10	HOOD ST	
17	HOOD ST	
25	HOOD ST	
35	HOOD ST	VACANT
37	HOOD ST	CAMBODIAN SPEAKING
4	HOOD ST	
40	HOOD ST	GAVE CARD TO DAUGHTER
67	HOOD ST	
15	HOUSTON PL	Make Appt. John Virgin 599-0452
19	HOUSTON PL	
25	HOUSTON PL	MAKE APPOINTMENT
26	HOUSTON PL	
14	HUDSON TER	INTERRANT, DIANE 592-5577. CALL FOR APPOINTMENT
77	HURD ST	
83	HURD ST	
11	IRVING RD	
15	KESLAR AVE	
21	KESLAR AVE	
47	KESLAR AVE	
72	KESLAR AVE	
25 OR 27	KIRTLAND ST	
33	KIRTLAND ST	
45	KIRTLAND ST	
61	KIRTLAND ST	NOT HOME FOR APP'T.

ADDRESS		NOTES
66	KIRTLAND ST	
69	KIRTLAND ST	
82	KIRTLAND ST	
9	KIRTLAND ST	
93	KIRTLAND ST	
7	LARCH RD	CALL FOR APPT. GLORIA 598-5754
10	LAUREL ST	CALL FOR APPOINTMENT
25	LAUREL ST	
33	LAUREL ST	
34	LAUREL ST	
35	LAUREL ST	
4,6	LAUREL ST	GAVE CARD TO TEEN
5	LAUREL ST	CALL FOR APPOINTMENT
51	LAUREL ST	
78	LAUREL ST	DENIED ACCESS
79	LAUREL ST	
9	LAUREL ST	LANDLORD HAS INSTRUCTED TENANT NOT TO ALLOW US IN GAVE CARD TO TENANT AND SHE WILL GIVE TO LL
11	LENDELL RD	
24	LENDELL RD	NOT CONVENIENT TIME. THEY WILL CALL
14	LINDEN ST	2 NOT HOME
17	LINDEN ST	2 NOT HOME
19	LINDEN ST	2 NOT HOME
31	LINDEN ST	2 NOTHOME
33	LINDEN ST	2 NOT HOME
36 1/2	LINDEN ST	
39	LINDEN ST	2 NOT HOME
41	LINDEN ST	2 NOT HOME
53	LINDEN ST	2 NOT HOME
57	LINDEN ST	ABANDONED HOUSE.
60	LINDEN ST	SPEAKS POLISH.
66	LINDEN ST	DOES NOT SPEAK ENGLISH
70,72	LINDEN ST	
9	LINDEN ST	PARENTS NOT HOME
10	LINWOOD PL	LEFT CARD
11	LINWOOD PL	
12	LINWOOD PL	
15	LINWOOD PL	
25	LINWOOD PL	
29	LINWOOD PL	
106	LINWOOD ST	

ADDRESS		NOTES
118	LINWOOD ST	NO CELLAR
147	LINWOOD ST	
15	LINWOOD ST	REFUSED TO LET US IN, WON'T MAKE APPT.
17	LINWOOD ST	2 NOT HOME
170	LINWOOD ST	2 NOT HOME
31	LINWOOD ST	SHE WILL CALL. NOT GOOD TIME
319	LINWOOD ST	CALL FOR APPT (617) 595-8255 Bob Randall
350	LINWOOD ST	LEFT A CARD
355	LINWOOD ST	LEFT CARD
38	LINWOOD ST	2 NOT HOME
46	LINWOOD ST	
82	LINWOOD ST	2 FAMILY HOUSE. NOT HOME
97	LINWOOD ST	
10	MARGIN ST	
24-34	MARGIN ST-RIVER BAY COND	CONDOS W/RESIDENT PRESIDENT. NO BASEMENTS-CRAWL SPACES ONLY AT A FEW UNITS. CONTACT JOAN MONTGOMERY AT 599-5855. SPOKE TO PATRICIA JOHNSON TREASURER
0	MARION & BOSTON	VACANT
41	MARION ST	NEED TO CHECK W/ LANDLORD - ART LEBRECH (LYNN)
43	MARION ST	
50,52	MARION ST	CALL NANCY GALLO BROKER FOR APPOINTMENT- SATURDAY ONLY
67	MARION ST	MAKE APPT. W/ LL - DACIE FUENTES 593-5710
71	MARION ST	VACANT
77 OR 79	MARION ST	VACANT- OWNER HERB BALDWIN AT 81/83 MARION ST
7	MEADOWBROOK RD	
8	MEADOWBROOK RD	
112	MENLO AVE	2 ND NOT HOME
21	MENLO AVE	2 ND NOT HOME
26	MENLO AVE	2 ND NOT HOME
59	MENLO AVE	WANTS TO MAKE AN APPOINTMENT (617) 595-2028 MURPHY
68	MENLO AVE	
79	MENLO AVE	
8	MENLO AVE	
11	MENLO TER	2 ND NOT HOME
34	MENLO TER	DECEASED
26	MILDRED ST	2 NOT HOME
8	MILDRED ST	
102	MOFFETT ST	
35	MOFFETT ST	
4	MOFFETT ST	
41	MOFFETT ST	

ADDRESS		NOTES
51	MOFFETT ST	
59	MOFFETT ST	
9	MOFFETT ST	
13	MORRIS ST	LANDLORD NOT HERE. LEFT A CARD
14	MORRIS ST	
15	MORRIS ST	LEFT CARD WITH RENTER
17	MORRIS ST	LEFT CARD WITH RENTER
20	MORRIS ST	2 NOT HOME
30	MORRIS ST	LANDLORD NOT HOME. HE WILL CALL
32	MORRIS ST	
11	MOULTON ST	LANDLORD SAID AN APPOINTMENT IS NECESSARY
15,17	MOULTON ST	
21 OR 23	MOULTON ST	
15	MURRAY ST	
2	MURRAY ST	VACANT PER CHILD NEIGHBOR. REALTY IS MELANSON RE 508-532-3636
23	MURRAY ST	
38	MURRAY ST	
39	MURRAY ST	denied entry
57	MURRAY ST	please call Phil 599-5786 for appt
64	MURRAY ST	call for appt
100	MYRTLE ST	
113	MYRTLE ST	
116	MYRTLE ST	
119	MYRTLE ST	
120	MYRTLE ST	HIGGINS
123	MYRTLE ST	
124	MYRTLE ST	
128	MYRTLE ST	MAKE APPOINT
13	MYRTLE ST	2 NOT HOME
131	MYRTLE ST	
148	MYRTLE ST	2 NOT HOME
152	MYRTLE ST	UNDER CONSTRUCTION. LEFT CARD
153	MYRTLE ST	
170	MYRTLE ST	ABANDONED
174	MYRTLE ST	
177	MYRTLE ST	
178	MYRTLE ST	2 NOT HOME
180	MYRTLE ST	MAKE APPOINTMENT (617) 592-8818 BOB TOMELLIO
186	MYRTLE ST	2 NOT HOME
22	MYRTLE ST	2 NOT HOME

ADDRESS		NOTES
26	MYRTLE ST	2 NOT HOME
36	MYRTLE ST	DENIED 2ND TIME
40	MYRTLE ST	2 NOT HOME
57	MYRTLE ST	2 NOT HOME
69	MYRTLE ST	GEORGE 595-9897
72	MYRTLE ST	
73	MYRTLE ST	FOR SALE
82	MYRTLE ST	SHE WILL CALL
88	MYRTLE ST	2 NOT HOME
94,96	MYRTLE ST	2 NOT HOME. 2 FAMILY HOUSE
98	MYRTLE ST	CAN'T GET THROUGH GATE
11	NELSON ST	LOCKED. LANDLORD TO CALL US. 3 FAMILY HOUSE
12	NELSON ST	2 NOT HOME
15	NELSON ST	2 NOT HOME
16	NELSON ST	VACANT. FIRE DAMAGE. DOORS BOARDED UP
18	NELSON ST	appartments managed by the Hall Company tel 593 -1506
20	NELSON ST	CALL FOR APPT., (617)578-4756, Huynh
26	NELSON ST	VACANT
32	NELSON ST	2 NOT HOME
35	NELSON ST	2 NOT HOME
36	NELSON ST	2 NOT HOME
44	NELSON ST	2 NOT HOME
7	NELSON ST	
9	NELSON ST	#9 NELSON ST DOES NOT EXIST
4	NEWCOMB AVE	
10	NEWTON AVE	
12	NEWTON AVE	
16	NEWTON AVE	
24	NEWTON AVE	
36	NEWTON AVE	
37	NEWTON AVE	2 NOT HOME
52	NEWTON AVE	
59	NEWTON AVE	CURRAN 2 NOT HOME
73	NEWTON AVE	
78	NEWTON AVE	
80	NEWTON AVE	
83	NEWTON AVE	2 NOT HOME
87	NEWTON AVE	JOSEPH CONDON, 2 NOT HOME
88	NEWTON AVE	
90	NEWTON AVE	

ADDRESS		NOTES
91	NEWTON AVE	2 NOT HOME
94	NEWTON AVE	
96	NEWTON AVE	
4	NICHOLSON ST	2 NOT HOME
48	NICHOLSON ST	2 NOT HOME
5	NICHOLSON ST	2 NOT HOME
52	NICHOLSON ST	SHE WILL CALL FOR APPOINTMENT (617) 581-7981 Kasabuski
27	NORTH FEDERAL ST	CALL FOR AN APPT. BETSY (LANDLORD) 592-2024.
42	NORTH FEDERAL ST	DUPLEX W/44
44	NORTH FEDERAL ST	
47,49	NORTH FEDERAL ST	
55	NORTH FEDERAL ST	
57	NORTH FEDERAL ST	
60	NORTH FEDERAL ST	KINGDOM HALL CHURCH.
69	NORTH FEDERAL ST	
15	NORTHSIDE AVE	
44	O'CALLAGHAN WAY	2 NOT HOME
54	O'CALLAGHAN WAY	2 NOT HOME
62	O'CALLAGHAN WAY	
73	O'CALLAGHAN WAY	2 NOT HOME
85	O'CALLAGHAN WAY	2 FAMILY BASEMENT APARTMENT
3	O'LEARY PL	2ND NOT HOME
7	O'LEARY PL	2ND NOT HOME
9	OAK ST	WON'T LET US IN
19	OAKLAND AVE	
23	OAKLAND AVE	CALL FOR APPT. 581-9915 DAVID GOLD
24	OAKLAND AVE	DENIED ACCESS. WON'T GIVE NAME OR NO.
48	OAKLAND AVE	2 NOT HOME
55,57	OAKLAND AVE	2 FAMILY HOUSE, 2 NOT HOME
10	OAKLAND TER	
19	OAKLAND TER	
24	OAKLAND TER	
5	OAKLAND TER	
6	OAKLAND TER	
100	ONTARIO ST	2 NOT HOME
111	ONTARIO ST	
114	ONTARIO ST	
115,117	ONTARIO ST	
128	ONTARIO ST	3 NOT HOME
18	ONTARIO ST	LANDLORD WILL CALL

ADDRESS		NOTES
24	ONTARIO ST	CALL FOR APPT (617) 592-7156 Richard Lembo
37	ONTARIO ST	2 NOT HOME
38	ONTARIO ST	2 NOT HOME
41	ONTARIO ST	CAN'T GET TO DOOR, DOG GATE
59,61	ONTARIO ST	CALL FOR APPT(617) 595-6683 Charles Fawler
72	ONTARIO ST	DOG AT GATE
73	ONTARIO ST	
77	ONTARIO ST	2 NOT HOME
81	ONTARIO ST	
90	ONTARIO ST	2 NOT HOME, HAYFORD
103	OSBORNE ST	
83	OSBORNE ST	
87	OSBORNE ST	
99	OSBORNE ST	
220	PARKLAND AVE	2 NOT HOME
248	PARKLAND AVE	WILLIAM O'DONNELL. THEY WILL CALL
256	PARKLAND AVE	2 NOT HOME
257	PARKLAND AVE	
261	PARKLAND AVE	
275	PARKLAND AVE	
280	PARKLAND AVE	2 NOT HOME
283	PARKLAND AVE	2 NOT HOME
287	PARKLAND AVE	2 NOT HOME
291	PARKLAND AVE	2 NOT HOME
294	PARKLAND AVE	
295	PARKLAND AVE	FOR SALE. VACANT. 231-3150, RHONDA COMBE
307	PARKLAND AVE	2 NOT HOME
320	PARKLAND AVE	2 NOT HOME
53	PENNY BROOK RD	
60	PENNY BROOK RD	2 ND NOT HOME
86	PENNY BROOK RD	2 ND NOT HOME
10	PERKINS ST	
26	PERKINS ST	
31	PERKINS ST	LEFT CARD
44	PERKINS ST	
69	PERKINS ST	
79	PERKINS ST	
85	PERKINS ST	2 NOT HOME
90	PERKINS ST	
93	PERKINS ST	

ADDRESS		NOTES
17	PERLEY ST	2ND NOT HOME
19	PERLEY ST	2ND NOT HOME
28,30	PERLEY ST	
40	PERLEY ST	
101	PINE GROVE AVE	GAVE THEM A CARD
106	PINE GROVE AVE	MAKE APPT.
145	PINE GROVE AVE	CALL FOR APPT. 593-4705 PRICILLA PERHAM.
25	PINE GROVE AVE	
29	PINE GROVE AVE	2ND NOT HOME
74	PINE GROVE AVE	
99	PINE GROVE AVE	
12	POPLAR ST	DENIED ACCESS
11	PRESTON ST	BURKE, CALL FOR APPOINTMENT @ 599-6288
7	PRESTON ST	2 NOT HOME. LEFT CARD
12	PRUDENCE RD	JACK TORISUON 592 - 5699 CALL FOR APPT
16	PRUDENCE RD	2 NOT HOME
79	PURDON AVE	2ND NOT AT HOME
25	RADDIN GROVE AVE	
30	RADDIN GROVE AVE	
36,38	RADDIN GROVE AVE	
51	RADDIN GROVE AVE	
64	RADDIN GROVE AVE	
9	RADDIN ST	
16	REED ST	2 NOT HOME
22	REED ST	2 NOT HOME
5	REED ST	2 NOT HOME
8	REED ST	2 NOT HOME
31	RESERVOIR RD	
49	RESERVOIR RD	
24	REVERE AVE	
109	ROBINSON ST	
111	ROBINSON ST	
17	ROBINSON ST	Vacant. R.E. Larry Green 593-4490
22	ROBINSON ST	Dixon, 2 not home
23	ROBINSON ST	
29	ROBINSON ST	2 not home
42	ROBINSON ST	CALL FOR APPT. (617) 595-0569 Richard McClory
49	ROBINSON ST	2 not home
55	ROBINSON ST	2 not home
69	ROBINSON ST	2 not home

ADDRESS		NOTES
77	ROBINSON ST	CALL (617) 596-2546 Mitchell
8	ROBINSON ST	2 not home
86	ROBINSON ST	2 not home
24	ROLLINS AVE	
28	ROLLINS AVE	
34	ROLLINS AVE	
19	ROLLINS TER	WILL CALL FOR APPT
10	ROSALIND TER	Deaf, Dogs
4	ROSALIND TER	
28	SADLER ST	
52	SADLER ST	
57	SADLER ST	
10	SAFFORD ST	
35	SAFFORD ST	2 NOT HOME
39	SAFFORD ST	
47	SAFFORD ST	2 NOT HOME
48	SAFFORD ST	
7	SAFFORD ST	
8	SAFFORD ST	
19	SARGEANTS CT	2 not home
30	SARGEANTS CT	Owner will make appointment
34	SARGEANTS CT	2 not home
41	SARGEANTS CT	2 not home
8,10	SARGEANTS CT	2 not home
19	SHADY LN	CARD TO DAUGHTER
24	SHADY LN	
30	SHADY LN	KOZAJIS - APPT PLEASE - PREFER SAT. - 592-2373
17	SHILLINGTON AVE	LEFT CARD
10	SIGOURNEY ST	
16	SPENCER ST	2 NOT HOME
2	SPENCER ST	2 NOT HOME
40	SPENCER ST	NEEDS PERMSSION FROM LANDLORD. NAME UNKNOWN
51	SPENCER ST	
70	SPENCER ST	
78	SPENCER ST	Call for appt.
12	SPRUCE ST	
24	SPRUCE ST	
27	SPRUCE ST	
31	SPRUCE ST	
38	SPRUCE ST	

ADDRESS		NOTES
19	STANGUS RD	DENIED ACCESS
9	STANGUS RD	2 NOT HOME
17	STARRATT RD	
21	STARRATT RD	
37	STARRATT RD	CALL FOR APPT
4	STARRATT RD	TEEN DIDN'T GO IN, DAVE OBRASO
5	STARRATT RD	
62	STARRATT RD	MAKE APPT. MARSHALL RICHARD 599-3360
80	STARRATT RD	
27	STERLING ST	
30	STERLING ST	
32	STERLING ST	
44	STERLING ST	
62	STERLING ST	
65	STERLING ST	
66	STERLING ST	
7	STERLING ST	
31	STILLES ST	CALL FOR APPOINTMENT
555	SUMMER ST	
602A	SUMMER ST	
606	SUMMER ST	BASEMENT LOCKED. CALL LANDLORD FOR APPT
648	SUMMER ST	TOM GERAS 592-6444
680	SUMMER ST	
697	SUMMER ST	
701	SUMMER ST	
706	SUMMER ST	
710	SUMMER ST	SPANISH SPOKEN-NEED TRANSLATOR
763	SUMMER ST	
800	SUMMER ST	LEFT CARD
817	SUMMER ST	2 NOT HOME
832,834	SUMMER ST	832, 834 2 FAMILY HOUSE
835	SUMMER ST	2 NOT HOME
840	SUMMER ST	2 NOT HOME
28	SUNNYSIDE RD	
29	SUNNYSIDE RD	MICHEAL REMSOM 581-9893. CALL FOR APPT
19	TAPLEY ST	
23	TAPLEY ST	
25	TAPLEY ST	
18	TEMPLE PL	
47	TONTOQUON AVE	

ADDRESS		NOTES
55	TONTOQUON AVE	ON SEPTIC PER NEIGHBOR
10	TRANFAGLIA AVE	2 NOT HOME
16	TRANFAGLIA AVE	2 NOT HOME
17	TRANFAGLIA AVE	CALL FOR APPT. - PAM CAMERON - 593-1878
71	TRANFAGLIA AVE	2 NOT HOME
16	WALNUT PK	
55	WALNUT PK	
56	WALNUT PK	
60	WALNUT PK	
61	WALNUT PK	
105	WALNUT ST	
113	WALNUT ST	
122	WALNUT ST	
128	WALNUT ST	
150	WALNUT ST	
190 (?)	WALNUT ST	
202	WALNUT ST	2- FAMILY HOUSE, DIANTGIKIS, IATROU
207	WALNUT ST	2 NOT HOME
208,210	WALNUT ST	LANDLORD WILL CALL
211	WALNUT ST	THERE IS A BROOK FLOWING ALONG SIDE AND IN BACK YARD
213	WALNUT ST	2 NOT HOME. WATCH OUT FOR THE DOG
287	WALNUT ST	CALL LANDLORD, RICHARD BARNBEY
312	WALNUT ST	
315	WALNUT ST	EASTERN LYNN RIFLE & REVOLVER CLUB. WILL NEED TO CONTACT
318	WALNUT ST	
321	WALNUT ST	
322	WALNUT ST	
342	WALNUT ST	
382	WALNUT ST	DESERTED
386B	WALNUT ST	PARENT NOT HOME
386D	WALNUT ST	
425	WALNUT ST	
427	WALNUT ST	CALL FOR APPOINTMENT 599-6062, SANDY PARENT.
429	WALNUT ST	DENIED ACCESS
431	WALNUT ST	CALL FOR APPOINTMENT 595-4587
46	WALNUT ST	
477	WALNUT ST	2 NOT HOME
488	WALNUT ST	
494	WALNUT ST	2 NOT HOME
495	WALNUT ST	FOR SALE

ADDRESS		NOTES
508	WALNUT ST	2 NOT HOME
515	WALNUT ST	2 NOT HOME
57	WALNUT ST	
607	WALNUT ST	
628	WALNUT ST	2 NOT HOME
70	WALNUT ST	TENNANT, SONIA DID NOT MAKE APPOINTMENT AND CAN NOT, WILL NOT LET ANYONE IN WITHOUT HEARING FROM LANDLORD FIRST.
74	WALNUT ST	NEED TO CALL FOR APPOINTMENT
84	WALNUT ST	
87	WALNUT ST	OWNER NAME: LEJEUNE
91	WALNUT ST	
97,99	WALNUT ST	AP'TS. FOR RENT PH. NO. 592-1098. THE FLOWER GALLERY ON GROUND FLOOR.
26	WASHINGTON ST	2 ND NOT HOME
42	WASHINGTON ST	2 ND NOT HOME, CREASES
11	WATERFORD ST	
17	WATERFORD ST	
107	WATERHILL ST	
109	WATERHILL ST	
115	WATERHILL ST	LANDLORD HAS KEY. CARD TO RESIDENT FOR LL
47	WATERHILL ST	2 NOT HOME
53	WATERHILL ST	ABANDONED HOUSE. NO ACCESS
55	WATERHILL ST	2 NOT HOME
74	WATERHILL ST	FOR SALE, CENTURY REALTY 593-0004
80	WATERHILL ST	DOG AT GATE
96	WATERHILL ST	"WOMAN DIED" NEIGHBOR. NOBODY HOME
99	WATERHILL ST	GUY DIED. ABANDONED HOUSE. VACANT
16	WEST SIGOURNEY ST	
23	WEST SIGOURNEY ST	
24	WEST SIGOURNEY ST	CALL FOR APPOINTMENT - LAMB 599- 3461
30	WEST SIGOURNEY ST	OWNER ON WAY OUT. GAVE CARD. SHE SAID WOULD MAKE APPPT
34	WEST SIGOURNEY ST	
42	WEST SIGOURNEY ST	
59	WEST SIGOURNEY ST	
60	WEST SIGOURNEY ST	
26	WILFRED ST	2ND NOT HOME
1	WILLIS CT	
11	WILLIS CT	
12	WILLIS CT	NOT AVAILABLE, CALL FOR APPOINTMENT
16	WILLIS CT	
3	WILLIS CT	NEED TO SCHEDULE APPOINTMENT

ADDRESS		NOTES
5	WILLIS CT	
10	WINNEPURKIT AVE	
100	WINNEPURKIT AVE	
11	WINNEPURKIT AVE	
120	WINNEPURKIT AVE	
13	WINNEPURKIT AVE	
17	WINNEPURKIT AVE	
2	WINNEPURKIT AVE	
20	WINNEPURKIT AVE	
21	WINNEPURKIT AVE	
23	WINNEPURKIT AVE	
34	WINNEPURKIT AVE	
40	WINNEPURKIT AVE	
42	WINNEPURKIT AVE	CALL FOR APPOINTMENT
50,52	WINNEPURKIT AVE	
75	WINNEPURKIT AVE	GAVE CARD TO OWNER. WILL CALL FOR APPT
70	WINTHROP ST	HERLIHY. INCONVENIENT TIME. WILL MAKE APPT.
96	WINTHROP ST	2ND NOT HOME
99	WINTHROP ST	2ND NOT HOME
3	WOODBINE ST	
1	WOODBURY AVE	MAKE APPT.
18	WOODBURY AVE	
34	WOODBURY AVE	
12	WOODLAWN ST	SMALLEY. LEFT CARD
121	WOODLAWN ST	CUTHBERT. 2 NOT HOME
123	WOODLAWN ST	
124	WOODLAWN ST	LEFT CARD
135	WOODLAWN ST	
136	WOODLAWN ST	
142	WOODLAWN ST	CARD TO OWNER. WILL MAKE APPT
143	WOODLAWN ST	
144	WOODLAWN ST	TRY FRI. PER NEIGHBOR
147	WOODLAWN ST	LEFT CARD
151	WOODLAWN ST	CALL FOR APPT.592-5808 WILLIAM MULCAHY
162	WOODLAWN ST	2 NOT HOME
74	WOODLAWN ST	
106	WOODMAN ST	VACANT
31	WOODMAN ST	
72	WOODMAN ST	
1,3	WYMAN ST	2 not home

ADDRESS		NOTES
113	WYMAN ST	2 not home
121	WYMAN ST	HE SAYS MAKE APPOINTMENT (617) 598-7417 Brian Duecy
128	WYMAN ST	Gave renter a card to call
16	WYMAN ST	Left her a card, she will call
20	WYMAN ST	
22	WYMAN ST	
24	WYMAN ST	
27	WYMAN ST	2 not home
28	WYMAN ST	
30	WYMAN ST	
34	WYMAN ST	
46	WYMAN ST	
50	WYMAN ST	
53	WYMAN ST	2 not home
55	WYMAN ST	2 not home
58	WYMAN ST	
62	WYMAN ST	
65	WYMAN ST	2 not home
66	WYMAN ST	
70	WYMAN ST	
73	WYMAN ST	2 not home
74	WYMAN ST	
78	WYMAN ST	
85	WYMAN ST	DID NOT GO IN. DOG
89	WYMAN ST	2 not home
93	WYMAN ST	2 not home

Appendix B

Summer Street Sewer Capacity Analysis

CDM Camp Dresser & McKee Inc.

consulting
engineering
construction
operations

Ten Cambridge Center
Cambridge, Massachusetts 02142
Tel: 617 252-8000 Fax: 617 621-2565

February 5, 1998

Mr. Leo Potter
Executive Director
Lynn Water and Sewer Commission
400 Parkland Avenue
Lynn, Massachusetts 01905

Subject: Summer Street and Cottage Street Sewer Separation
Summer Street Sewer Capacity Analysis

Dear Mr. Potter:

The purpose of this letter is to provide the Commission with a basis for moving forward with a program to eliminate private inflow sources to further reduce the potential for overflow events at CSO Outlet #003 (CSO #003). Toward this end, we have evaluated the capacity of the Summer Street sewer upstream of the CSO #003 regulator manhole to handle estimated present day wastewater flows including private inflow. For the purpose of this evaluation only the Summer Street tributary area (SSTA) is included as, the Cottage Street tributary area (CSTA) is downstream of the regulator manhole and CSO #003.

The evaluation draws from previous studies to estimate the dry weather sanitary flow, inflow and infiltration in the SSTA. The analysis demonstrates that private inflow sources must be addressed to reduce the occurrence of overflows at CSO #003. Alternatives to eliminate overflows either by providing capacity to transport and treat the private inflow quantity or removing the private inflow sources through a program of disconnection in the SSTA are presented.

Existing System

As shown on the attached profile (Appendix A) by Hazen and Sawyer and Clinton Bogert Associates, the Summer Street sewer, upstream of the CSO #003 regulator manhole, was reconstructed to replace a section of the sewer which was in poor structural condition. However, downstream of the regulator manhole, the sewer remains an 18" diameter pipe for a distance of about 700 feet. At this point, the pipe increases to 24" diameter and continues at this size to its connection with the Western Interceptor at Cottage Street. Based on record drawings, the profile of the existing 18" pipe is laid at an inverse grade for approximately 320 feet immediately downstream of the regulator manhole. This condition reduces the hydraulic capacity of the 18" sewer. Assuming a velocity of 2 feet /second through this reach, the limiting capacity of the 18" diameter sewer is calculated to be 3.45 cubic feet per second (cfs). Estimates of the hydraulic capacity of the 18" sewer and for a 24" diameter replacement sewer are included in Appendix A.

Proposed system improvements in the SSTA, to remove public inflow, will significantly reduce the volume of runoff tributary to the Summer Street sewer. However, because of the inverse grade and the limiting capacity of the 18-inch diameter sewer, it is critical to eliminate extraneous flows to minimize the occurrence of overflows at CSO #003.

In order to determine the amount of public inflow that must be removed, CDM evaluated a condition of average, daily dry weather flow and the occurrence of the 1-year design storm.

Dry Weather Flow

The average daily dry weather flow rate for the SSTA was determined from flow gauging performed in 1988 during high groundwater periods (January - May). Gauging was performed as part of the Phase I Facilities Plan and the reported dry weather flow rate is 216 cfs.

Infiltration

In 1995, as part of the "Infiltration/Inflow Analysis Western Interceptor Tributary Area" report prepared by CDM, flow isolation was performed in the SSTA. In April and May of 1994, infiltration rates were measured in five sub-areas, which comprise the SSTA. Although the gauging locations used in this study were not at the same locations as the dry weather flow meter locations, the total tributary area is the same for both studies. Results indicate 0.62 cfs of average daily dry weather flow is infiltration.

Private Inflow

Two primary sources of private inflow are sump pumps and downspouts that discharge directly to the wastewater collection system. As part of the field investigations conducted during preparation of the Draft Preliminary Design Report dated November 1997 prepared by CDM, approximately 75% of the homes within the SSTA and CSTA were inspected for sump pumps and downspouts. A total of 226 sump pumps were confirmed connected to the wastewater collection system; and, an additional 181 were suspected connected. Assuming half of the suspected connections are connected to the wastewater collection system, the total number of sump pumps connected is 316. This number is increased by 75% to 425, to account for the houses not inspected. Estimated private inflow attributed to sump pumps and downspouts for the design storm (1-year, 6-hour duration) from the SSTA were calculated based on the results of these investigations.

Sump Pumps

Of the 425 sump pumps identified as part of the CDM field investigation, the total number of sump pumps connected to the wastewater collection system in the SSTA is reported to be 266. The estimated discharge related to the operation of these sump pumps was determined using the Massachusetts DEP Guidelines for Performing I/I Analysis and SSES dated 1993. This guide suggests a range of 3 to 6 gallons per minute (gpm) for estimating sump pump discharge. Assuming half the sump pumps are on at any given time and a maximum

discharge rate of 6 gpm, the estimated peak discharge rate for sump pumps is calculated to be 800 gpm (3.56 cfs). The total volume of flow assuming a 6-hour duration is calculated to be approximately 288,000 gallons.

Downspouts

Of the 10,000 downspouts identified through house-to-house inspections performed by CDM in both the SSTA and the CSTA, only about 100 were confirmed connected to the wastewater collection system. Allowing an increase of about 33% to account for houses not inspected brings the total number of connected downspouts to 135. Of the total number of downspouts, 80 are in the SSTA. Based on the DEP guide an allowance of 3 gpm per downspout is suggested for the 1-year design storm. The discharge rate associated with a 1-year design storm of 6 hour duration is estimated to be 240 gpm (0.54 cfs). The total volume of discharge for a six-hour duration is calculated to be 86,400 gallons.

The total rate and volume of private inflow associated with sump pumps and downspouts, connected to the wastewater collection system in the SSTA, is calculated to be 1040 gpm (4.10 cfs) and 374,400 gallons respectively.

Analysis

Assuming a condition of average, daily dry weather flow (216 cfs) and private inflow due to the occurrence of the 1-year design storm (4.1 cfs), the total flow tributary to the CSO #003 regulator manhole is estimated to be 6.26 cfs. However, because the capacity of the 18" diameter section of the Summer Street sewer is limited to 3.45 cfs, overflows will occur at CSO #003 under the assumed conditions. It should be noted that at times when sanitary wastewater flows exceed assumed average daily rates, less capacity is available for private inflow.

Figures included in Appendix B illustrate the calculated depth of flow in the 18" diameter sewer for three situations; 1) average dry weather flow plus infiltration; 2) average dry weather flow plus infiltration and sump pumps only and; 3) average dry weather flow plus infiltration, sump pumps and downspouts.

These illustrations show that even after catch basins have been removed from the combined system, the existing 18" sewer will surcharge under the assumed design conditions. Also included in Appendix B are figures illustrating calculated depths of flow for the same three conditions assuming the 18" diameter sewer is replaced with a 24" diameter pipe.

Alternatives and Costs

Two alternatives were evaluated to reduce or eliminate overflows at CSO #003.

1. Increase the capacity of the 18" diameter section of the Summer Street sewer to 24" diameter pipe and transport and treat the estimated volume of private inflow.

2. Implement a program to eliminate sump pumps and downspouts.

Alternative 1

The cost to replace the 675 foot section of existing 18" diameter pipe with new 24" diameter pipe (needed to handle average dry weather flow of 216 cfs and 4.1 cfs of private inflow) is estimated to be about $270,000. The cost to treat private inflow is based on a unit cost of treatment of $0.07 per gallon of reported in the June 1995 "Infiltration/Inflow Analysis Western Interceptor Tributary Area" report. This cost includes fuel, power, and chemical costs. The total volume of flow resulting from the 1 Year design storm from sump pumps (288,000 gallons) and downspouts (86,400 gallons) is calculated to be 374,400 gallons. Therefore the treatment cost associated with one storm event is calculated to be about $26,200.

In summary, alternative 1 would require a capital expenditure of $270,000 and an annual cost of $26,200 to handle and treat private inflow. Not included in this evaluation are costs to upgrade the existing WWTP to meet the increased flow to the plant.

Alternative 2

The second alternative assumes the elimination of sump pumps and downspouts currently connected to the wastewater collection system. Under this program, we recommend a step approach to address the easier disconnects first and more difficult disconnects later in the program. From the analysis, it also appears that the removal of sump pumps is most critical and we recommend these be removed first. Within this group there are varying degrees of difficulty. Many will only require minimal changes to internal plumbing to remove the sump pump discharge from the internal domestic plumbing and to redirect the discharge to a new location.

The alternate location of the discharge will be at the owner's discretion and the homeowner would receive a flat one-time reimbursement of $500 per sump pump to perform the work. Based on the estimated 266 sump pumps located in the SSTA, the cost of this program is estimated to be $133,000.

The second phase of the disconnection program would require the disconnection of downspouts. A flat one-time reimbursement of $20 per downspout is proposed for this work. The total cost to remove the estimated 80 downspouts in the SSTA is $1600.

The total cost of the disconnection program for the SSTA is summarized below:

Number of Inflow Source	Connections	Cost to Disconnect (Per connection)	Total Cost
Sump Pumps	266	$500	$133,000
Downspouts	80	$20	$1600
			$134,600

Should the Commission wish to disconnect all sump pumps and downspouts in the CSTA concurrent with the inflow reduction program in the SSTA, the additional cost is $80,600, bringing the total cost to $215,200.

Conclusions

Based on the cost analysis presented above, it is apparent that a private inflow disconnection program is cost effective and needed to prevent overflows at CSO #003 for the adopted design conditions.

Therefore, we recommend that the Commission implement a voluntary removal program to disconnect sump pumps and downspouts. We recommend that this program be conducted coincident with the construction of the combined sewer separation project for both the SSTA and CSTA. It should be noted that the disconnection program within the SSTA is critical since this area is located above CSO #003. Sump pump removal should be given first priority.

CDM has determined from the Massachusetts Department of Environmental Protection (MDEP) that the sump pump and downspout removal costs will not eligible for reimbursement under the State Revolving Fund (SRF) program.

Please do not hesitate to contact me at 617-252-8264, if you have any questions or comments regarding this matter.
Very truly yours,

CAMP DRESSER & McKEE INC.

Ronald M Lepri

Ronald M Lepri
Vice President

RML/kjh
Appendices/Enclosures

cc: Daniel O'Neill, LWSC
William Callahan, CDM
file 1.5.2

APPENDIX A

SUMMER STREET SEWER

209

208A

REMOVE EXIST. MANHOLE
CONSTRUCT MANHOLE
STA. 2+01

C50 #003

PIPE TO
OVER FLOW
MANHOLE

SEE NEXT
PAGE

32"

36" @ 0.001

18" @ 0.001

INV. 4.00

PIPE TO OVER FLOW
MANHOLE

INV. 3.79

INV. 3.60

INV. 3.25

0+00

1+00

2+00

3+00

4+00

5+00

STRAWBERRY
BROOK
CULVERT

SUMMER STREET - PROFILE

0 40 80 120FT.

HORIZONTAL

0 4 8 12F

VERTICAL

204

IF THIS DIME
THAN 8" IN A
THEN USE TH

REMOVE EXIST. MANHOLE
CONSTRUCT MANHOLE
STA. 7+86=0+00

SEE PREVIOUS PAGE

EXIST. GRADE ABOPSX.

15"

18"

INV. 3.95

18" @ 0.0026

18" @ 0.0026

10"

24"

INV. 3.26

18"

10"

18"

INV. 1.72

INV. 1.95

INV. 1.43

15
10
5
0
-5

5+00
6+00
7+00
8+00
9+00

REET – PROFILE

0 4 8 12FT

VERTICAL

PIPE
PIPE SIZE
18"AND SM
21" TO 27
30" TO 36

IF THIS DIMENSION IS LESS THAN 9" IN ANY DIRECTION THEN USE THE NEXT LARGER SIZE MANHOLE.

B

FRAME AND COVER

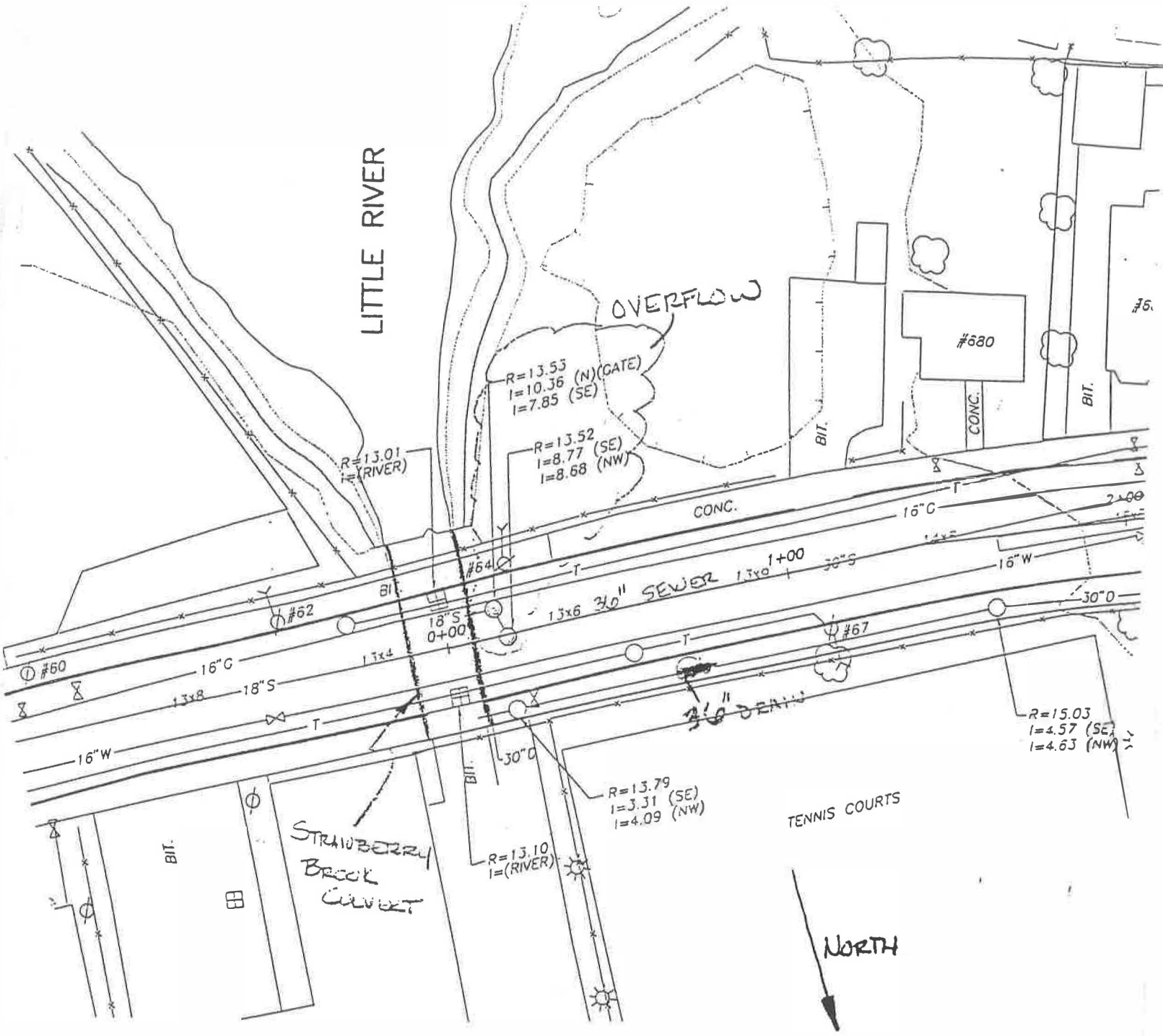
1" GROUT

8"

8"

4" S.S. PIPE WITH THREADED CAP

2'-8"DIA.


LITTLE RIVER
OVERFLOW
#680
R=13.53
l=10.36 (N)(GATE)
l=7.85 (SE)
R=13.52
l=8.77 (SE)
l=8.68 (NW)
R=13.01
l=(RIVER)
CONC.
BIT.
16"C
16"W
18"S
0+00
1+00
2+00
13x6 30" SEWER
13x8
13x4
#60
#62
#64
#67
30"S
30"C
30"D
30" DERIP
R=15.03
l=4.57 (SE)
l=4.63 (NW)
R=13.79
l=3.31 (SE)
l=4.09 (NW)
R=13.10
l=(RIVER)
STRAWBERRY BROOK CULVERT
TENNIS COURTS
NORTH

Lynn Water and Sewer Commission
Summer Street
Hydraulic Analysis

Street	Q (MGD)	Q (cfs)	Velocity (ft/s)	Dimensions (feet)	Area (sqft)	Wetted Perimeter (feet)	Lynn City Datum: Approx. Upstream Invert	Lynn City Datum: Approx. Downstream Invert	Distance (ft)	Slope (ft/ft)	Mat'l	n
Existing 18-inch Summer Street sewer from Regulator to the downstream 24-inch pipe	2.23	3.45	2.0	1.50	1.77	4.71	3.79	3.6	177	0.0011	CI	0.013
	3.17	4.91	2.8	1.50	1.77	4.71	3.95	3.6	161	0.0022	CI	0.013
	8.03	12.43	7.0	1.50	1.77	4.71	3.95	2.28	120	0.0139	CI	0.013
	3.47	5.37	3.0	1.50	1.77	4.71	2.28	1.95	127	0.0026	CI	0.013
	3.44	5.32	3.0	1.50	1.77	4.71	1.95	1.72	90	0.0026	CI	0.013
New 24-inch pipe to replace the existing 18-inch pipe from Summer Street at the Regulator to the downstream 24-inch pipe	4.80	7.43	2.4	2.00	3.14	6.28	3.79	3.6	177	0.0011	RCP	0.013
	6.84	10.58	3.4	2.00	3.14	6.28	3.95	3.6	161	0.0022	RCP	0.013
	17.30	26.76	8.5	2.00	3.14	6.28	3.95	2.28	120	0.0139	RCP	0.013
	7.47	11.56	3.7	2.00	3.14	6.28	2.28	1.95	127	0.0026	RCP	0.013
	7.41	11.47	3.7	2.00	3.14	6.28	1.95	1.72	90	0.0026	RCP	0.013

Total length (ft) **675**

Installed Pipe Cost **$84,375**

Common Item Cost **$185,625**

Total Cost **$270,000**

APPENDIX B

ESTIMATED DEPTH OF FLOW

CAMP DRESSER & McKEE

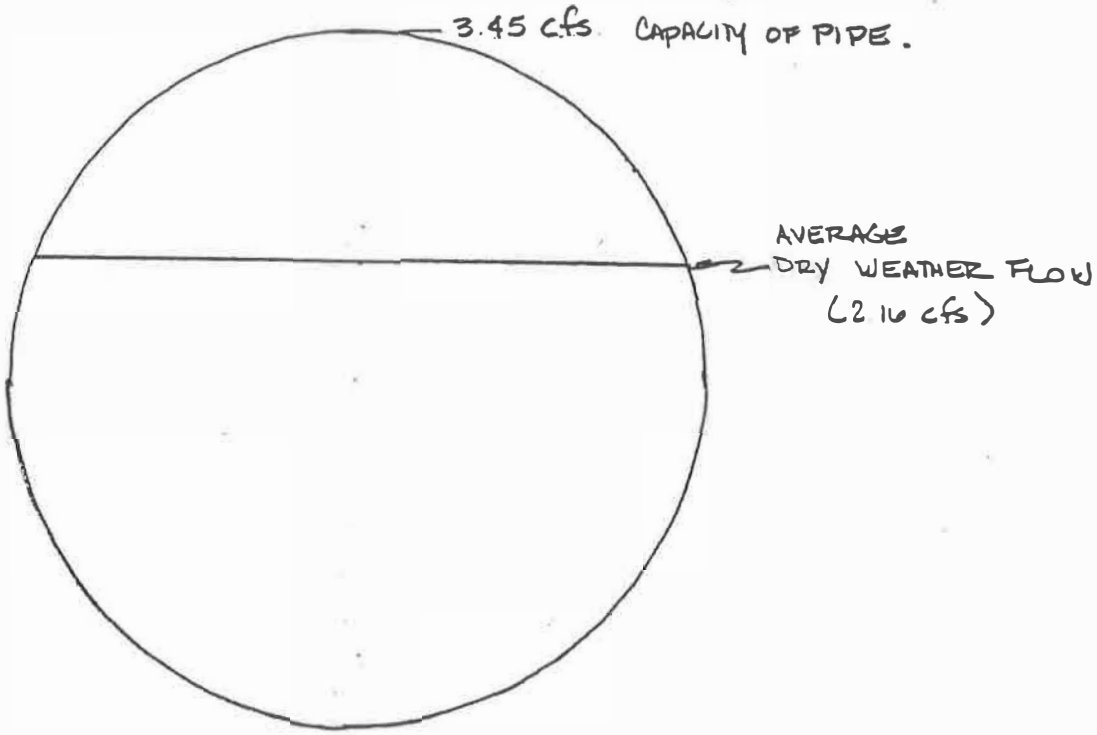
CLIENT _____ JOB NO. _____ COMPUTED BY _____

PROJECT _____ DATE CHECKED _____ DATE _____

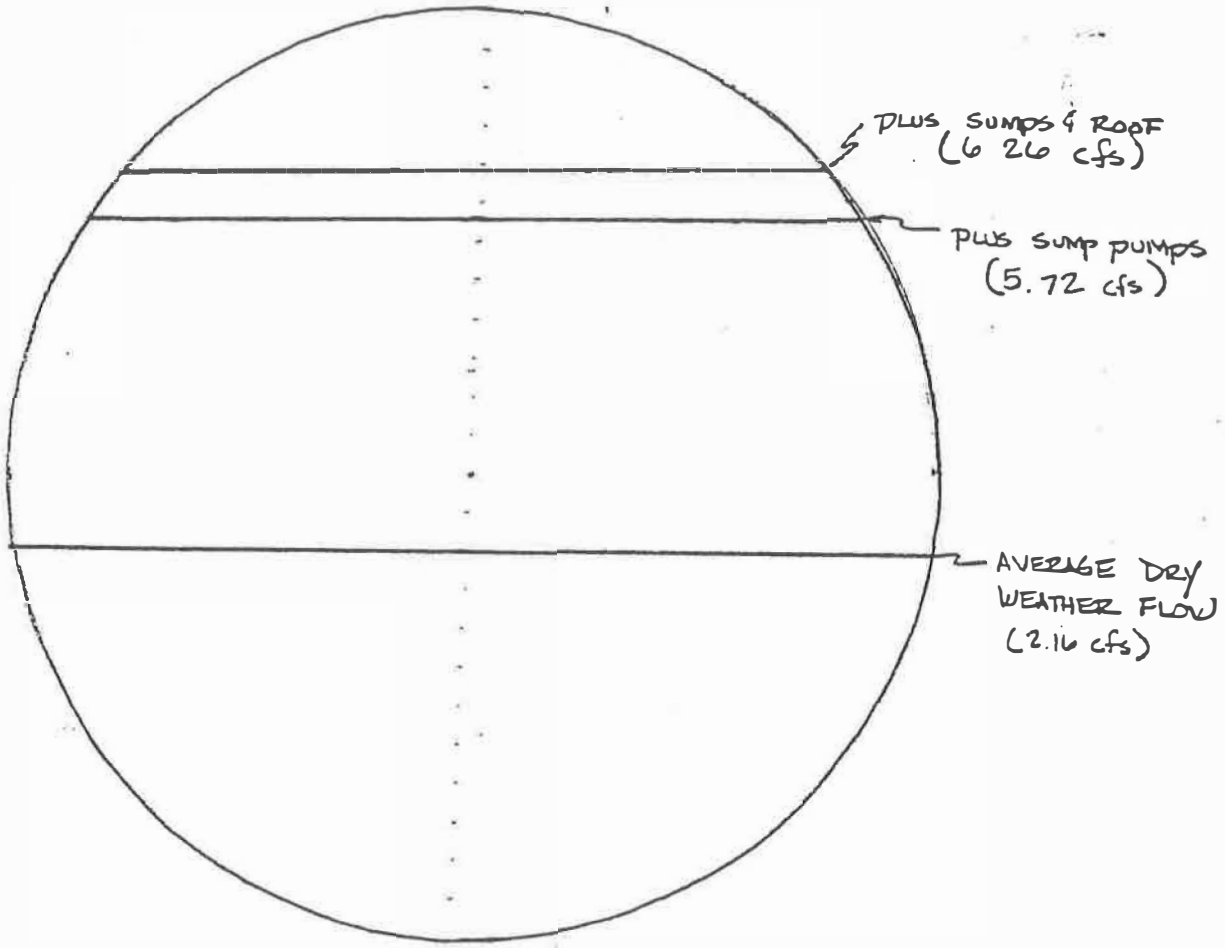
DETAIL _____ CHECKED BY _____ PAGE NO. _____

HYDRAULIC PROFILE 18" ∅ PIPE

- - - - - - PLUS SUMP PUMPS (5.72 cfs.) (ESTIMATED)



HYDRAULIC PROFILE 24" ⌀ PIPE



Lynn Water and Sewer Commission
Summer Street
Hydraulic Analysis

Street	Q (MGD)	Q (cfs)	Velocity (ft/s)	Dimensions (feet)	Area (sqft)	Wetted Perimeter (feet)	Lynn City Datum: Approx. Upstream Invert	Lynn City Datum: Approx. Downstream Invert	Distance (ft)	Slope (ft/ft)	Mat'l	n
Existing 18-inch Summer Street sewer from Regulator to the downstream 24-inch pipe	2.23	3.45	2.0	1.50	1.77	4.71	3.79	3.6	177	0.0011	CI	0.013
	3.17	4.91	2.8	1.50	1.77	4.71	3.95	3.6	161	0.0022	CI	0.013
	8.03	12.43	7.0	1.50	1.77	4.71	3.95	2.28	120	0.0139	CI	0.013
	3.47	5.37	3.0	1.50	1.77	4.71	2.28	1.95	127	0.0026	CI	0.013
	3.44	5.32	3.0	1.50	1.77	4.71	1.95	1.72	90	0.0026	CI	0.013
New 24-inch pipe to replace the existing 18-inch pipe from Summer Street at the Regulator to the downstream 24-inch pipe	4.80	7.43	2.4	2.00	3.14	6.28	3.79	3.6	177	0.0011	RCP	0.013
	6.84	10.58	3.4	2.00	3.14	6.28	3.95	3.6	161	0.0022	RCP	0.013
	17.30	26.76	8.5	2.00	3.14	6.28	3.95	2.28	120	0.0139	RCP	0.013
	7.47	11.56	3.7	2.00	3.14	6.28	2.28	1.95	127	0.0026	RCP	0.013
	7.41	11.47	3.7	2.00	3.14	6.28	1.95	1.72	90	0.0026	RCP	0.013

Total length (ft) 675

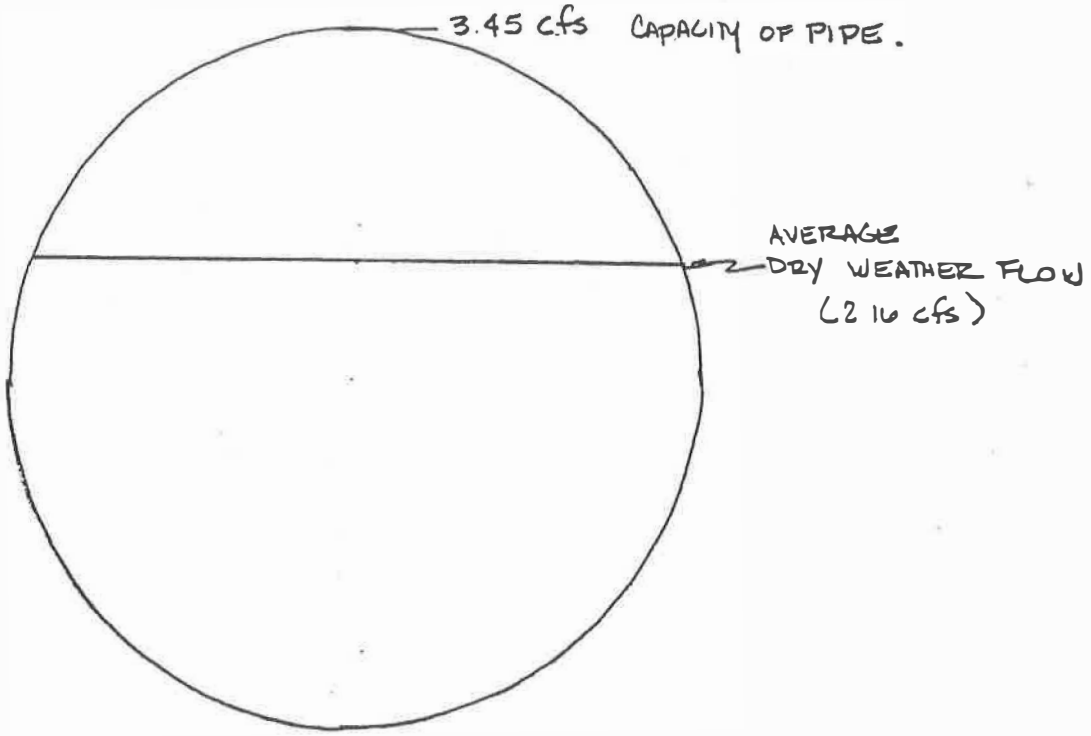
Installed Pipe Cost $84,375

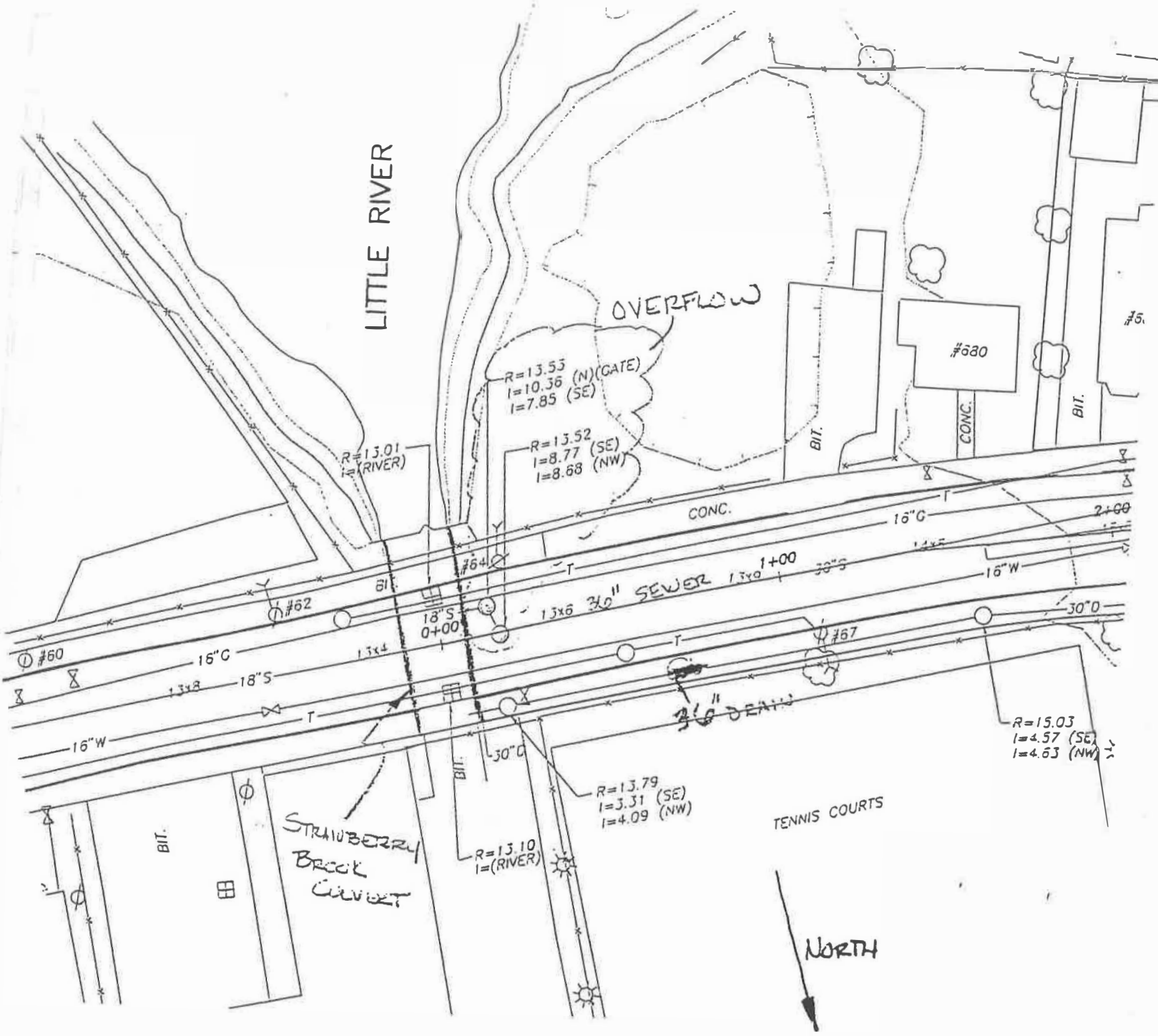
Common Item Cost $185,625

Total Cost $270,000

HYDRAULIC PROFILE 18" ϕ PIPE

- - - - - - - PLUS SUMP PUMPS (5.72 cfs.) (ESTIMATED)




LITTLE RIVER
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#680
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CONC.
BIT.
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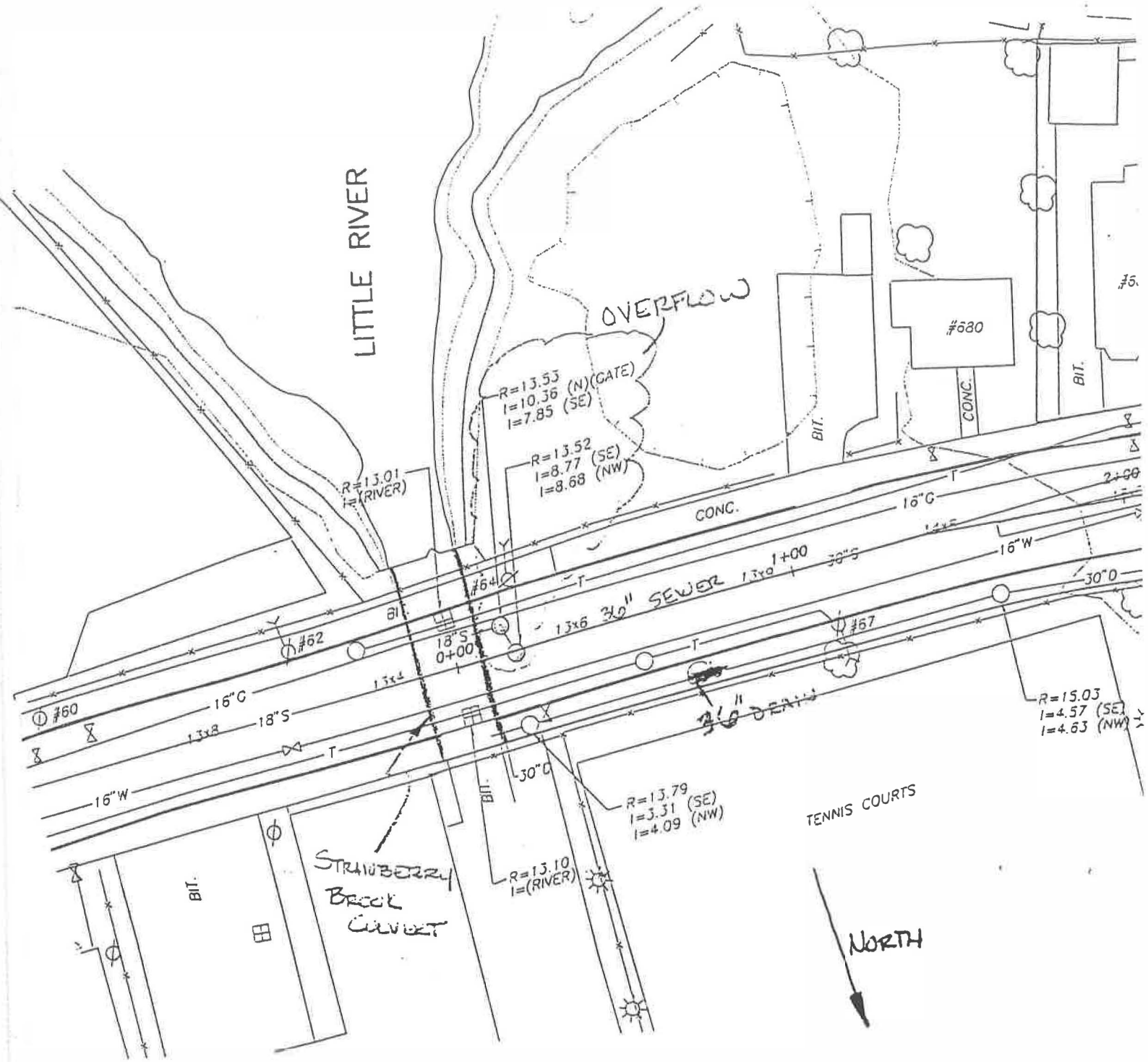
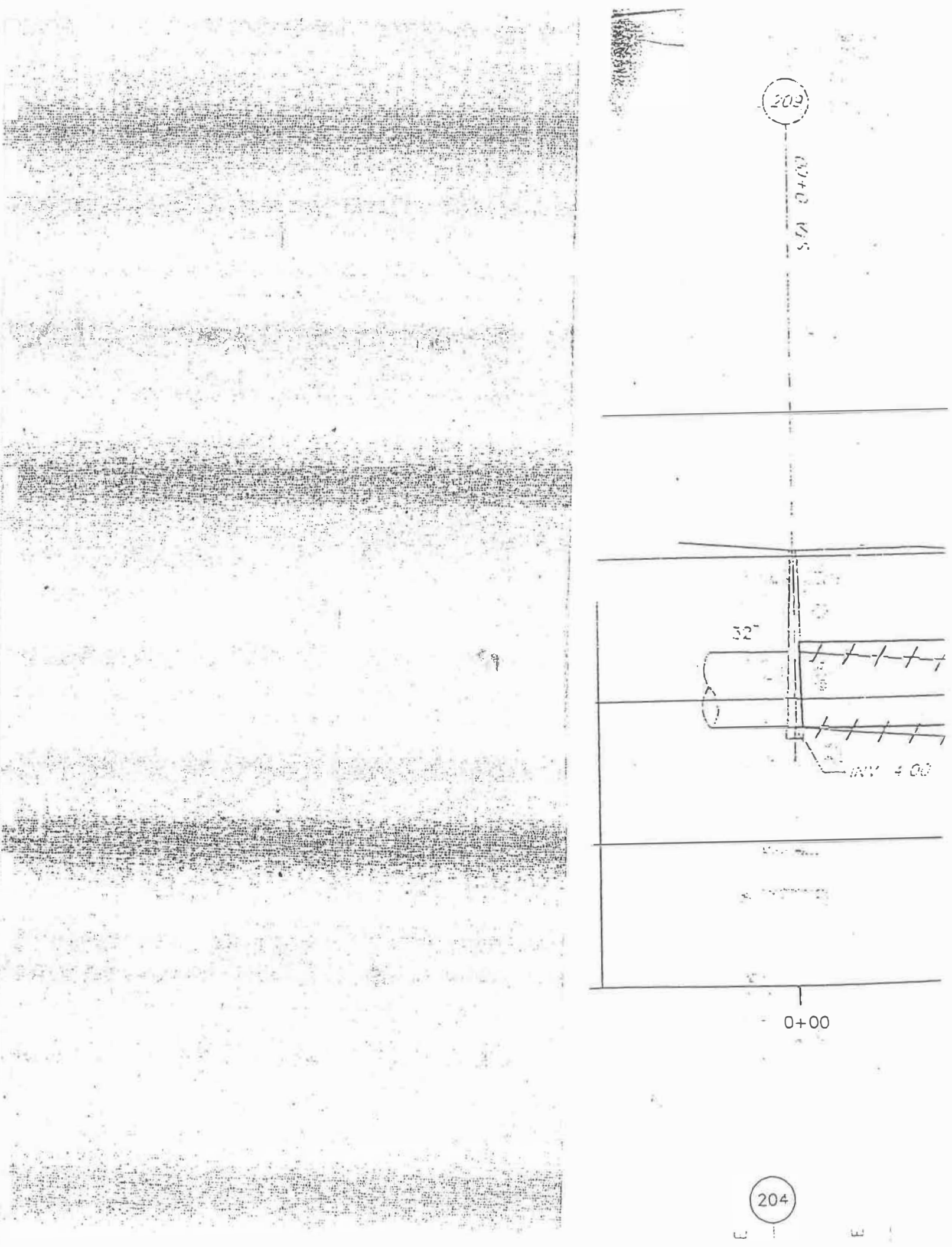
I=10.36 (N)(GATE)
I=7.85 (SE)
R=13.52
I=8.77 (SE)
I=8.68 (NW)
R=13.01
I=(RIVER)
CONC.
16"C
2+00
16"W
#64
#62
#60
#67
1+00
30"S
18"S
0+00
13x6 36" SEWER 13x8
13x4
18"S
16"C
16"W
30"D
36" DEAD
30"C
BIT.
R=15.03
I=4.57 (SE)
I=4.63 (NW)
R=13.79
I=3.31 (SE)
I=4.09 (NW)
TENNIS COURTS
STRAWBERRY
BROOK
CULVERT
R=13.10
I=(RIVER)
BIT.
NORTH


LITTLE RIVER
OVERFLOW
#680
BIT.
CONC.
R=13.53
l=10.36 (N)(GATE)
l=7.85 (SE)
R=13.52
l=8.77 (SE)
l=8.68 (NW)
R=13.01
l=(RIVER)
#64
#62
#60
#67
CONC.
16"C
16"W
18"S
0+00
1+00
13x6 30" SEWER
13x8
13x4
30"D
30"C
R=15.03
l=4.57 (SE)
l=4.63 (NW)
R=13.79
l=3.31 (SE)
l=4.09 (NW)
R=13.10
l=(RIVER)
STRAWBERRY BROOK CULVERT
TENNIS COURTS
NORTH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CAMP DRESSER & McKEE | CLIENT | JOB NO. | COMPUTED BY
PROJECT | DATE CHECKED | DATE
DETAIL | CHECKED BY | PAGE NO.

Hydraulic Profile — 24" ϕ Pipe